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More important because far more common is the clinical picture mentioned as *subacute nephritis*, wet or nephrotic type. This group consists mostly of male patients, Hindus and Mohammedans, from 2 to 50 years of age, admitted as general anasarca, that is a bulging ascites, œdema of legs and frequently of the scrotum but very little—if any—puffiness of the face, sometimes a moderate double pleural effusion. The patients' history indicates an insidious onset of the swelling, a few months prior to admission and no definite complaints except general weakness and the discomfort due to the swelling, no headache or vomiting, and no sore throat. The clinical findings are uniform in all these cases: albumin 0.25 to 3 per cent, moderate or large numbers of every kind of cast, red cells present in all cases mostly ++ to +++, leucocytosis to a small or moderate amount, the concentration power usually reduced to a specific gravity of 1015 to 1018 and reaching 1024 only in one case, blood pressure was, in about half of these cases, increased between 135 and 160 with normal diastolic pressure, heart changes according to the pressure, fundal changes conspicuously absent except for 2 cases with some mild atherosclerotic changes, and blood urea from 28 to 40 mg. All these patients had a big spleen floating in the ascites, and in some of them protruding from the abdomen when the ascites had disappeared. The malarial infection showed different degrees of activity: none of this group was admitted with regular attacks. Parasites (BT rings) were present in a minority, malaria flocculation test was mostly positive and nearly every one of these cases had an occasional attack or rigor and fever during a longer lasting observation, never appearing again after anti-malarial treatment.

Instead of discussing the prognosis of this kind of subacute nephritis, it will be better to describe how they responded to treatment. Kept in bed, on a diet consisting of one pint of milk, one pint of buttermilk, half a pint of coffee and 8 ounces of bread or whole-wheat *chapati*, some of these patients passed much larger quantities of urine and chlorides, and lost weight from day to day without any additional treatment; e.g., a boy of 18, 30 pounds in 16 days, a Mohammedan of 40, 50 pounds in 5 weeks, and one of the rare female cases 22 pounds in 10 days. But the majority of this group did not respond to diet and rest alone; their weight remained constant or increased after a slight initial reduction, and neither diuretic mixture nor diuretin with caffein succeeded in eliminating the retained water and salts. We tried indigenous drugs taking Chopra's invaluable experience as guide, we used *Bœrhaavia diffusa* (*Punarnava*) and *Herpestis monniera* (*gokhru*) extracts, supplied by three different Indian firms, we did not get a satisfactory result, whether we tried each of these drugs separately or both of them combined, whether we gave the

dose prescribed or increased it up to twice this amount. Dr. Subbaramiah suggested the use of *Cynodon dactylon*, a grass growing locally and frequently used as a popular diuretic; we gave up to 12 drachms of a concentrated alcoholic extract per day. The plant grown during the rains had in some cases a good effect, not afterwards when the grass became dry. Mercurial diuretics are contra-indicated because of the glomerular lesion, though they produce sometimes a good diuresis for a day or two. It was a most unsatisfactory solution of this therapeutic problem to tap the ascites once in 10 or 14 days and to wait helplessly until the peritoneal cavity filled again.

The most simple solution was found as we started to use quinine in full dose without delay in all splenomegalic cases of subacute nephritis in spite of absence of fever as soon as the weight became constant for 3 days or began to rise; the table shows a typical weight chart of one of these cases.

Such a therapeutic effect makes the diagnosis 'malarial nephritis' most probable, even for those who do not believe that the regular co-existence of malarial infection and this type of renal anasarca is sufficient to recognize the ætiological rôle of the malarial infection. Slightly less satisfying than the diuretic effect is the healing effect of anti-malarial treatment, estimated by the improvement of pathological findings in the urine. In some of our cases albumin, red cells and casts disappeared entirely from the urine as in the case whose weight chart is reproduced in the table. This patient showed on admission a high albuminuria, plenty of red cells and every field of the sediment crowded with granular casts; 3 weeks later—after a full course of quinine and no other treatment—the most carefully repeated search did not show one single red cell or cast, and only faint traces of albumin. But not every case reacts like that; several of these left the hospital with red cells still present, casts definitely less but not entirely absent, albuminuria reduced though not altogether cured; the increased blood pressure was no more rapidly improved than strict diet and rest usually achieve. Taken altogether it seems almost certain that by far the most of these renal anasarca cases are due to malarial nephritis. It seems improbable that our cases belong to the same clinical group as those accompanying or following quartan malaria, described by Watson (1904), Clarke (1912), Goldie (Palestine), Manson-Bahr and Maybury (1927), Carothers (East Africa), Surbeck (Sumatra), and Giglioli (Br. Guiana), who found in a small percentage malignant tertian infections. Quartan malaria is a rarity here; only one of our subacute nephritis cases gave a history which made quartan fever probable. Owing to the chronicity and low activity of the malarial infection in most of our cases, parasites have been found in a minority of them only; but these

TABLE

Date	Quantity of urine	Specific gravity	Chloride estimation, per cent	Weight, lb.	Report	Treatment
5th Feb. ..	200	1020	1.04	110	Urine: Alb. +++ R. B. C. ++ Lc. ++ Hb.: 39 per cent Gran. casts: ++++ Epith. casts: + B. P.: 125/78 M. P.: B. T. rings M. F.: positive Concentration test: 1024 Fundal examination:	..
6th " ..	400	1018	0.78	110½	..	..
7th " ..	170	1020	1.30	109½	..	..
8th " ..	360	1020	1.30	108½	..	..
9th " ..	300	1020	1.04	109½	..	Quinine: gr. x, t.d.s.
10th " ..	547	1020	0.91	109½	..	Do.
11th " ..	420	1020	1.17	109½	..	Do.
12th " ..	296	1020	1.04	109½	W. R.: negative Klines: negative Urine: Alb. + R. B. C. + Lc. + Gran. casts: ++ Epith. casts: +	Do.
13th " ..	1,241	1020	1.04	108	..	Do.
14th " ..	755	1018	1.04	107½	..	Do.
15th " ..	795	1018	..	106	Hb.: 40 per cent	Do.
16th " ..	1,730	1012	0.78	103½	Blood urea: 40 mg.	Do.
17th " ..	2,452	..	0.78	101½	..	Quinine: gr. v, t.d.s.
18th " ..	1,295	1010	0.78	96½	..	Do.
19th " ..	1,862	1012	0.65	91	..	Do.
20th " ..	1,655	1010	0.65	91	..	Do.
21st " ..	710	1008	0.52	87½	..	Do.
22nd " ..	1,548	1010	..	84½	Urine: Alb. + R. B. C. + Lc. + Casts: +	Do.
23rd " ..	900	1012	0.52	82½	..	Do. Stopped.
24th " ..	972	1012	0.52	83½	..	..
25th " ..	1,200	1010	0.26	83	..	..
26th " ..	819	1016	0.26	83½	..	..
27th " ..	466	1020	0.39	83½	..	..
28th " ..	1,412	1020	0.39	83½	Hb.: 46 per cent	..
1st March	1,366	1020	0.39	83	Urine: Alb. traces R. B. C. nil Lc. nil Casts: nil Triple phosphates: +	..

parasites were *Plasmodium vivax* never *P. malariae*.

To explain how malaria causes nephritis is theoretically possible only but it seems most probable that the kidney damage is an allergic process, due to the sensitization to 'foreign' proteins belonging either to the parasites or derived from destroyed body-tissue; that would explain why only in a small fraction of all malarial infections an acute or subacute nephritis develops, as a certain constitutional type would be the necessary condition for the appearance of this 'kidney-hypersensitivity'.

(c) *Ancylostomiasis*.—Hookworm infection is by far the most frequent cause of general anasarca in Mysore. To study its manifestations, its prognosis and treatment is therefore most interesting especially as apparently nowhere else—neither in Iraq nor in America nor even as near as the Madras Presidency, are such

desperate looking cases of hookworm disease to be found as we see here every day.

The incidence of infection is amazingly high, at least 60 per cent of our hospital patients pass hookworm eggs—men and women are both heavily infected, the ryot far more of course than the city dweller. The clinical picture of general anasarca due to hookworm disease is so uniform that the diagnosis is usually established as soon as one sees the patient. The face waxy pale presenting a greyish hue and puffy, the eyelids swollen as in the worst cases of acute nephritis, tongue and palate looking like grey paper, a mighty ascites containing 25 pints and more of straw-coloured transudate, nearly free of protein, specific gravity about 1006; maximal swelling of legs and scrotum completes the external picture. The pulse rate is high, the heart enlarged to both sides to such an extent that it seems to touch both lateral chest walls—

the largest hearts one can see are hookworm hearts. The configuration is mitral, but such an enlargement is only seen, when due to valvular disease, in combined mitral-tricuspidal-aortic lesions; a harsh systolic murmur is always present over all the valves, its maximum usually nearer the pulmonary than the mitral area and in many cases well conducted outwards up to the posterior axillary line, just as described in textbooks as proving an organic mitral disease. To make the imitation of a double mitral still more perfect, a systolic thrill is sometimes distinctly palpable. And yet the differential diagnosis has to be made and is not difficult; a mitral disease giving rise to such a degree of anasarca is highly dyspnoeic (orthopnoeic), struggling for air, showing all signs of lung congestion, a huge tender liver, icteric or subicteric sclerae, cyanosis of lips and finger nails, a normal or increased hæmoglobin content, a normal diastolic pressure, and signs of kidney congestion in the urine. Quite different are behaviour and signs in hookworm anasarca. The patients are lying quietly flat on their back or on one side with a characteristic apathetic expression, sometimes even covering the head with the blanket, hardly answering questions; lung congestion is mostly absent, the liver slightly enlarged, if at all, and not tender, and no subicterus present, if not due to malarial hæmolysis, cyanosis is absent. The hæmoglobin content is the lowest recorded in living beings, we guessed values of about 8 per cent and in many cases Sahli's hæmoglobinometer shows 11 or 12 per cent on admission. The systolic pressure is normal or slightly diminished like in mitral disease, but the diastolic pressure is distinctly low, usually between 65 and 50, slowly increasing with general improvement. Very important for the diagnosis from congestive heart-failure, as well as from acute nephritis or nephrosis, is the urine examination which does not show either albumin or any pathological sediment; even traces of albumin, a few red cells or occasional casts are proof of a complication, as far as my experience goes, and are never to be found in pure hookworm disease.

*Discussion.*—It is all important, it is often literally a question of life or death, to find out the cause of general anasarca in every individual case; when we treat a congestive heart-failure as ancylostomiasis, because the patient passes hookworm eggs, or when we treat a hookworm anasarca as a heart-failure, because the heart shows all signs of a valvular lesion, we won't save the patient's life. In these hookworm cases exists only one line of rational treatment: to improve the blood condition so far that carbon-tetrachloride or tetrachlorethylene can be given without risk. Though hookworm anaemia is known as a typical microcytic-hypochromic anaemia that simply has to improve quickly on administration of sufficient doses of ferrous iron, some of our patients do not follow this rule. We give in every case 90 grains of freshly

prepared Bland's pills per day and the effect is practically always a quick improvement from Sahli 12 to 18 or 20, but from this level upwards the blood improvement progresses quickly and satisfactorily only in the majority of our cases, not in all of them. A minority remains that requires crude liver extract for further improvement; these cases are characterized by a comparatively high colour index of about 0.8, whereas the simple iron deficiency anaemias have an index of about 0.35 to 0.5. The higher index is not due to a higher hæmoglobin content, but to a still more reduced red cell count; figures of 0.7 million red cells and hæmoglobin 12 per cent are typical for the liver-requiring cases. Though the general condition improves surprisingly quickly under this treatment, accompanied by plenty of milk, wheat *chapatis*, rice polishing or marmite, ascites and oedema require their own treatment. The patients and we—always in need of beds—cannot wait until the ascites begins slowly to vanish 6 to 8 weeks after admission when the hypoproteinaemia is so far repaired that the colloid osmotic pressure of the blood plasma rises to a normal level. We have to speed up the fluid elimination by using diuretics.

The same difficulties arise again as in the nephritis group; mercurial diuretics are dangerous as long as a substantial anaemia persists producing diarrhoea instead of diuresis; in our first publication on the diuretic action of novasurol (1919-1920) Saxl and myself warned against its use in anaemic and cachectic conditions; *gokhru*, *punarnava*, *mistura diuretica*, caffeine and diuretin have no more effect in hookworm anasarca than in the malarial nephritis; cynodon extract was in several cases quite useful but after the rains stopped, it apparently lost its diuretic qualities; disappointing also was apocynum. We had to try again and again until we found that the combined use of ammonium chloride grs. xx, calcium chloride grs. v, five times a day and urea drachms v, *t.d.s.*, has the best diuretic effect though in some cases diarrhoea compels one to stop this treatment for 2 to 3 days. In most of our cases 3 weeks of this combined anti-anaemic and diuretic treatment improve the general condition so far that, at a hæmoglobin level of 35 to 40 per cent, the usual anti-helminthic treatment may be applied without any bad by-effect, yielding innumerable hookworms (*Necator americanus*); rarely a patient is discharged unless 3 motions examined on alternate days have been found free of hookworm eggs.

### Conclusion

*Summarizing* one has to say: general anasarca in our hospital cases is due to heart-failure, nephritis, or ancylostomiasis. The heart-failure is mostly a consequence of valvular lesions or of essential hypertension, a condition remarkably frequent among Brahmans, living for many

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HYDROTHERAPY IN TYPHOID FEVER

By G. R. McROBERT, M.D., F.R.C.P.  
LIEUTENANT-COLONEL, I.M.S.

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It is generally recognized that the administration of large quantities of fluid has a beneficial effect in the treatment of most specific fevers.

In enteric fever in particular, it is most important to maintain the fluid intake at a high level.

With a large number of severe cases of enteric in a busy ward, it is very difficult to ensure that semi-conscious patients imbibe a sufficient quantity of water, even if arrangements are made for suitable containers to be at hand.

During the past two years I have been using continuous rectal drip saline in toxic and semi-conscious enteric fever cases, and I am satisfied that this measure helps in reducing toxæmia and in ensuring a continuous supply of fluid which could not be guaranteed by any other nursing method.

The virulence of enteric fever in this country seems to vary greatly from year to year and from one outbreak to another, but after long experience of the disease I have come to the conclusion that continuous rectal drip provides a valuable weapon in combating the severe toxæmia which one meets so often. In this I am supported by senior nursing sisters with many years of experience.

In the warm climate of south India we have, as a rule, no difficulty in administering by the rectal route 6 pints of normal saline in 24 hours, i.e., an hourly rate of 5 ounces. Even in patients with diarrhoea considerable absorption takes place.

A soft catheter should be used and introduced just within the rectum. A glass visible dripper

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centuries on strictest vegetarian food. The nephritis, either an acute or subacute glomerulo-nephritis, is frequently so closely connected with malarial infection that many of the cases seem to belong to the interesting clinical entity, 'malarial nephritis'. By far the largest number of our anasarca cases are due to hook-worm infection. Regarding the treatment—the heart-failure cases respond very well to digitalis and mercurial diuretics; the malarial nephritis to milk diet and rest in bed, and, if water retention still persists, quinine is the best diuretic; ascites and œdema in ancylostomiasis respond best to ammonium chloride and urea.

My thanks are due to the Government of Mysore, whose kindness gave me the opportunity to do here clinical work, and to my staff whose ideal co-operation made these investigations possible.

## INTRAPARTUM UTERINE RUPTURE

(WITH A REPORT ON FOUR CASES)

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THIS accident, which is one of the most serious in obstetrics, is fortunately rare. Davis (1927) gives an incidence of 1 in 810 labours in 184 cases from the records of the New York Lying-in Hospital. Figures for India are not available, but three cases occurred in 2,016 deliveries at the Sassoon Hospital, Poona, in the last 2 years—an incidence of 1: 672. Both hospitals deal largely with cases of difficult labour, whereas Shears (1924) referring to all labours gives the incidence as 1 in 3,500.

It is, however, questionable whether rupture does not actually occur more often than is generally supposed, particularly in countries like India where labour often takes place many miles from medical aid, and where pelvic deformities are common.

The usual textbook description of intrapartum rupture of the uterus states that it is predisposed to by any condition which may have weakened the uterine wall. Previous Cæsarean section or myomectomy, adherent placenta, and too vigorous curettage may be instanced, and debility and too frequent child-bearing may be other predisposing causes.

The actual rupture is brought about spontaneously (as in neglected obstructed labours due to malpresentations or pelvic contraction) or by the manipulations necessary to deal with these conditions, such as version or craniotomy.

The cases (less common in India) where rupture takes place through a weak operation scar of the uterine wall are omitted from the following description of uterine rupture. The more common type in this country takes place through a thinned-out lower uterine segment, and (again according to the textbooks) is accompanied by such dramatic symptoms and signs that the diagnosis could hardly be missed.

The story is usually as follows:—During a long and tedious second stage of labour the uterine contractions get more and more frequent and painful, and the intervals between them become progressively shorter. The whole

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is necessary but one can easily be improvised from an old-fashioned fountain pen filler.

There seems to be no advantage in adding glucose to the rectal saline.

During the war of 1914-18, it was found in Mesopotamia that intravenous normal saline reduced the toxæmia in cases of louse typhus. I commend the use of continuous rectal saline to any who may come into contact with that disease also.

uterus is very tender and the foetal parts hard to make out. The retraction ring of Bandl can be seen or felt above the symphysis and even rising up towards the umbilical region, while the round ligaments too may be felt as tense cords.

Suddenly, at the acme of a pain, the patient may feel that something has given way inside her and cry out with the pain. After that she has great relief and all pains cease. Signs of shock and internal hæmorrhage soon supervene.

On examination at this stage the foetal parts may be very easily felt, if the child has escaped completely through the rent. Otherwise the uterus feels irregular in shape but not so hard and tense as before. On vaginal examination, there is a certain amount of bleeding and the presenting part is found to have receded somewhat and to be no longer jammed in the pelvis. The actual tear in the uterine wall can sometimes be felt.

Such a picture may be true of the majority of ruptures occurring in labour, but, as the following cases show, the diagnosis is not by any means always so easy.

In the first place, rupture may occur when the patient is anaesthetized for some obstetrical operation, in which case the rupture may not be recognized. When the patient dies later after delivery, her death is returned as due to 'obstetric shock' or 'hæmorrhage', unless a post-mortem examination is made.

Further the rupture may be only a small extra-peritoneal one not involving big vessels. Such patients may recover after delivery without the true nature of the condition being recognized. The result would be a residual scar which might yield in a subsequent labour.

Even if the classical signs of impending rupture have been present and have been followed by rupture, no trained observer may have been there to see them, and the patient may die before she can be brought to hospital.

There would seem also to be another type of case in which 'silent' rupture takes place without dramatic symptoms. The patient may have had several normal deliveries, and no marked disproportion or malpresentation can be found. Yet gradual rupture occurs, the rent possibly extending slowly with each pain. Eventually pains become weaker and cease while signs of collapse gradually supervene for no apparent reason. There is little to draw attention to the very serious accident that has occurred.

Such cases are probably due to a uterine muscle which has been weakened, thinned and stretched by rapidly succeeding pregnancies and the general debility of the patient. The diagnosis of rupture is likely to be missed in such cases, though they are not uncommon.

The following cases illustrate some of the above points:—

*Case 1.*—A 2nd para, aged 24 years, who had had a forceps delivery five years ago with a stillborn child, was admitted at 5 a.m. on the 16th July, 1939, with a

history of prolonged labour and early rupture of the membranes. She had not attended any antenatal clinic.

On examination the uterus was contracting strongly, the foetal head not engaged and lying in the 1st vertex position; no foetal heart sounds heard; os two fingers dilated and presenting part high. Promontory easily felt.

It was decided to wait for dilatation of the cervix and then deliver by craniotomy.

12-30 p.m. Patient getting distressed: os four fingers dilated with oedematous anterior lip; marked caput.

Under general anaesthesia the head was perforated, four long Kocher's forceps were applied to the scalp round the perforation, and one pound weight tied to their handles. Brain matter came out freely.

Following the anaesthetic, all uterine contractions ceased, in spite of pituitrin in small doses twice repeated. Prontosil 10 c.cm. was given about 4-30 p.m. as a prophylactic, and repeated periodically.

By 12-30 a.m. on 17th July, 1939, the patient was exhausted, pulse 100, temperature 100, abdomen distended and tender, os very oedematous and loose, though nearly fully dilated, uterine contractions feeble and presenting part still high.

Under general anaesthesia the doctor on duty removed the Kocher's forceps and extracted the child with a cephalotribe with some difficulty at 1-30 a.m. The placenta had not appeared by 2-45 a.m., so it was expressed by Crede's method, and a hot intra-uterine douche given. There was very little bleeding throughout.

*Subsequent progress.*—The patient was given altogether five injections of prontosil and soluseptasine and also sulphonamide tablets 2 q.i.d. for five days with intravenous glucose.

Her abdomen remained very tender and inclined to be distended, and her condition was never good. Her temperature varied between 99 to 99.6 for the next four days. She vomited twice and her pulse was feeble and thready.

On the 19th July, 1939, the peritoneum was drained through a supra-pubic incision under local anaesthesia. Some gas with reddish-brown fluid escaped. This was sent for culture, and meanwhile 20 c.cm. of anti-gas-gangrene serum was given.

On the 20th July, 1939, the constipation had given way to a terminal diarrhoea—4 to 5 motions per day. She died on the 22nd July, 1939, with the temperature rising to 104°F. and respirations 48 just before death. This was 6½ days after admission.

*Post-mortem examination.*—Dr. A. J. Naronha showed about ½ pint of reddish-brown fluid and old blood clots in the pelvis. The uterus was 5½ inches long and there was a recent tear in the anterior uterine wall about 2½ inches long running upwards and to the left above the peritoneal reflection on the bladder.

The uterine wall showed a few areas of hæmorrhage; endometrium septic but not thickened. Peritoneum not markedly inflamed.

Culture of the peritoneal fluid produced no anaerobes.

There were areas of consolidation in the lungs, but no obvious broncho-pneumonia.

*Comment.*—It is difficult to make out exactly when rupture occurred, but it seems probable that the extraction with the cephalotribe through an oedematous cervix with thinned-out lower uterine segment may have caused the actual rupture. As the patient was under an anaesthetic and the uterus not contracting strongly, the clinical signs of rupture were never present, and the condition was only found post mortem.

The reddish fluid removed on draining the peritoneum might have made one suspect some intraperitoneal injury, but the accompanying gas made one think of an anaerobic infection with gas-forming organisms.

*Case 2.*—A 7th para, farmer's wife, aged about 35 years, was admitted in labour on the 16th January, 1940, at 12-10 a.m. Her previous six deliveries had been normal full-term labours and she had not attended any ante-natal clinic.

On examination there was nothing remarkable noted. The child was in the vertex-I position, head engaging but not well flexed.

Membranes ruptured at 2-15 a.m. when the os was 3/5 dilated. Foetal heart 136 per minute.

At 8 a.m. she was seen by the resident medical officer when the foetal heart sounds were absent and the patient's pulse feeble.

When I saw her at 8-30 her pulse was 144; os 3 fingers dilated and the foetal head was high up and floating. The uterus was not contracting well, and what was thought to be placental tissue could be felt anteriorly. There was considerable bleeding on examination, and placenta praevia was diagnosed.

Under light general anaesthesia and novocain infiltration, the abdomen was opened and the child, placenta and membranes were found lying free amongst the intestines, and were removed. There was a tear of the antero-lateral wall of the uterus extending into the cervix, and it was this tear that had probably been mistaken for placental tissue *per vaginam*. The pelvis was not noticeably contracted.

Subtotal hysterectomy was rapidly carried out followed by the usual post-operative treatment for shock. No compatible blood for transfusion was available.

*Subsequent progress.*—The patient rallied well, apart from offensive lochia and fever up to 100° for the first six days and she left hospital on the 22nd day.

*Comment.*—Rupture must have occurred early on the 16th January, 1940, the day of admission, without exciting the notice of patient or nurses—the 'silent' type of rupture. Even when seen at 8-30 a.m. she was thought to be a case of placenta praevia, though the head which had previously been reported as engaging was now high up and floating. Luckily operative treatment was carried out and the true condition dealt with.

The cause of the rupture in this case was probably degenerative changes in the uterine wall following repeated pregnancies and possibly sepsis. There had been no intra-vaginal manipulations as far as could be discovered, apart from vaginal examinations in hospital.

*Case 3.*—A 6th para, aged 30 years, wife of a tailor, was admitted in labour on the 16th November, 1939, at 10 a.m. Her first three children were normal full-term deliveries. Fourth child—transverse presentation and stillborn. Fifth child—forceps delivery in hospital, living, aged 1½ years.

She had been having pains for three days.

On admission her condition was good. Child in vertex-I position, head floating, but could be made to engage. Uterine contractions good and foetal heart normal.

*Progress.*—11-50 a.m. Membranes ruptured. Os 2/5 dilated. 3-45 p.m. child passing meconium. Head engaged. Os fully dilated.

Forceps then applied under general anaesthesia by the medical officer on duty, without success.

On examination at 5-30 p.m. one could feel the foetal parts very easily just beneath the abdominal wall. No uterine contractions. Foetal heart sounds absent. Child appeared to be still in the first-vertex position, but an ill-defined swelling could be felt to the right. The head was still above the brim. Mother's pulse 90 per minute.

*Per vaginam.*—Dark blood escaping. Cord prolapsed and not pulsating. Presenting part not felt.

Ruptured uterus was diagnosed.

*Operation.*—Under local and general anaesthesia the abdomen was opened and the child and membranes and placenta were found loose in the abdominal cavity, and were removed. The tear in the uterus extended from the anterior part of the lower uterine segment upwards and to the left. There was very little blood in the peritoneal cavity.

The pelvis had well-marked pectineal eminences and promontory of the sacrum.

Subtotal hysterectomy was carried out and the patient did very well. She had a rigor and fever up to 100°F. on the first day (? due to saline infusion) and later a mild bronchitis but left hospital 26 days after admission.

*Comment.*—Rupture in this case must have occurred during the 'failed-forceps' operation under anaesthesia. The notes state that the 'head was fixed and abdomen very tense' at that time. This was only three hours or so after the os was only 2/5 dilated, so that to rupture so early in labour it is possible that the uterine wall itself was not normal. Certainly the patient had not been allowed to linger on in obstructed labour hour after hour.

The records of the Bai Motlibai Hospital show only one case of ruptured uterus as having occurred in the last four years and I am indebted to Dr. V.N. Shirodkar for permission to publish the notes of this case.

*Case 4.*—The patient was a 3rd para, aged 34 years, who had had two stillborn children previously, following otherwise normal labours. The last one was one year ago. Her general condition was 'poorly'. Her Wassermann reaction was negative during her attendance at the ante-natal department. She had some uterine prolapse in the early months, for which a pessary had been fitted.

On admission on the 6th June, 1940, at 11-45 p.m. she was full-term and in labour. Child in vertex-I position; head engaged, but foetal heart slow and feeble.

Her measurements were 10 inches, 9 inches, and 7 inches. Her pulse rate 120. No uterine contractions were present, and liquor amnii was draining from the vagina.

*Per vaginam.*—The os was four fingers dilated and a large 'caput' could be felt.

At 6 a.m. on 7th June, 1940, the patient vomited twice. Her pulse was now 136 and of poor volume; upper abdomen distended; no pains felt. The patient appeared cyanosed.

She was given intravenous glucose and coramine and also inhalations of oxygen, but died at 6-30 a.m.

*Post-mortem examination by Dr. P. V. Gharpure.*—On opening the abdomen a large amount of blood and blood clots came out. The foetus was found free in the peritoneal cavity, head in the pelvis. Uterus contracted and lying to the left of and behind the foetus. The contracted uterus held within it the greater part of the placenta. There was a tear of the right side of the uterus in the lower uterine segment extending from the supravaginal cervix to the ovarian ligament and involving the broad ligament.

*Comment.*—This seems to have been a typical case of 'silent' rupture, without any dramatic symptoms and signs to attract the attention of those looking after the patient. She never got the severe pains usually described as associated with rupture of the uterus, neither was there any manipulative interference or

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## HIDDEN SEPSIS IN THE PALATINE TONSILS

By F. H. WHYTE, M.B., M.Ch., F.R.C.S.I.

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*Introductory.*—Anything that is hidden has always a certain interest which may grow as we get indications of its location and nature. We spend much of our time in looking for foci of infection, and their discovery and eradication often bring most gratifying results; conversely, overlooked foci produce many of the tragic and irreparable conditions that we frequently see in general practice. I refer to advanced cases of arthritis, cardiovascular disease, and patients with general deterioration of function and structure, caused apparently by months or even years of intoxication, or by the direct assault of germs lurking in concealed nests of infection.

Recent revelations have prompted me to devise an instrument to assist exploration for the hidden dangers found in the tonsils, and to write this article to review the position generally.

### *Tonsil speculum and squeezer*

The instrument is simply a useful tongue depressor with knobs on one end to act as tonsil squeezers. A glance at the sketch conveys its primary uses—to hold down the tongue and at the same time express pus from the supratonsillar fossæ and crypts by pressure along the anterior pillars.

This tonsil speculum, in adult and children's sizes, has been made for me by the kind co-

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anæsthesia in her case. A microscopical examination of the uterine muscle might possibly have shown some defect to account for the rupture in this case.

### *Summary*

1. Four cases of rupture of the uterus in labour are reported.

2. Attention is drawn to the difficulty in diagnosis in many of these cases. Out of the four cases only one was definitely and correctly diagnosed before operation or post-mortem examination.

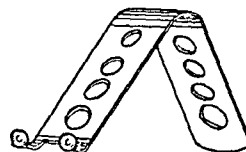
3. It seems probable that the condition is missed more frequently than one would suppose, particularly in the absence of post-mortem examinations on cases dying of shock and hæmorrhage.

4. It is suggested that the textbook descriptions of rupture of the uterus should be supplemented by a description of the 'silent' type of rupture here described.

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operation of Messrs. Allibhoy Vallijee & Sons\*. The only criticism I would make on these models is that the knobs should be placed a little more laterally on the necks. I have also to thank Messrs. Down Bros., London, for an earlier pattern, excellent in every way except that the 'ears' were too sharp.



Author's tonsil speculum and squeezer.

In practice, I find this combined tongue depressor and tonsil squeezer most efficient and simple to use. It is easy to carry around, does not frighten the patient, and the necessary firm pressure does not hurt. The handle end serves as an ordinary tongue depressor. Many methods of examining the tonsils involve the use of a head light and both hands for the introduction of special single-functioned instruments which are cumbersome, alarming, and liable to produce that facile reflex which may disturb the patient's latest meal. There are some patients who are most intolerant of any instrumental examination of the throat; for these considerable patience is required and it is found if they practise mouth-breathing for a few minutes and fully extend their chins, one can usually manage.

Textbooks commonly recommend the pressure of a tongue depressor, with or without a second one to depress the tongue, or the end of a spoon, instruments that are often much too sharp and clumsy. A knob of cotton-wool in artery forceps is more satisfactory.

There is nothing at all new, of course, about pressing the anterior pillars to reveal pus. My hypothesis is that it is not done often enough or efficiently enough, and that simplicity of equipment and technique are here, as everywhere, of primary importance. Similar instruments such as those of Hartman, Tilley, Howarth, Way, etc., and the suction tubes of Bier and Eve require, as a rule, the assistance of a tongue depressor and head light and are special equipment usually not available, and which in use are associated with some fuss which is seldom appreciated by children, or nervous patients.

This speculum not only reveals pus but also supplies information as to mobility, capsulitis, the size and depth of the tonsils, and the nature and extent of their folds which helps in deciding the nature of the anæsthetic and operation if such are necessary.

In considering the tonsils for pathological changes an incorrect diagnosis is encouraged by

\* The Alvi Works, Multan Cantonment, can supply a certain demand at a very reasonable cost of Rs. 5 each.

a healthy appearance of the throat, the small superficial size of the tonsils, the absence of injection of the anterior pillars, or a negative history of repeated sore throat or tonsillitis, and if an attempt is made to press out pus some improvised and unsatisfactory method is adopted. One does not always care to ask a tired parent to chase downstairs for the usual dessertspoon or to refuse the services of an ornamental one which may be offered on return. I have occasionally used the handle of a tooth brush but more often than not they are too pointed.

It would be well always to bear in mind that a perfectly healthy looking tonsil may contain much pus, particularly in young adults and often enough in children, and that no examination is satisfactory unless firm pressure is applied to the anterior pillars. To miss a quiet focus of infection in the gall bladder, kidney, appendix or a nasal sinus, is certainly excusable, but less so when overlooked in the superficial and more common sites. Quite recently of three patients admitted to adjoining beds, all with serious disease of heart or kidneys, it was found that although all three had normal looking tonsils each had also gross lacunar sepsis.

It is regrettable to find so much diversity of advice being given concerning treatment and the indications for the removal of tonsils. On the one hand, there is the operator who advocates the removal of practically all the tonsils he sees, and on the other, the practitioner who only uses direct inspection and unless he observes some striking abnormality proceeds no further. In addition there are various methods of active treatment in common use which are at best improvisations or temporary in effect, and liable to promote a sense of security that is false or to lead to ultimate disaster unless applied only in the case of very selected patients who can be depended upon for regular examination. This diversity is largely due to the methods used in the examination of the patient's throat.

#### *Tonsillectomy*

A short general survey may, I hope, assist some to clarify their clinical opinions on a subject liable to wide divergence of view.

Considering patients who have been examined with reference to the condition of their throats, one is inclined to believe that, though many useful tonsils have been removed in childhood, it is certain that many most dangerous ones have been overlooked, more particularly in young adults. The early effects in each case being insidious rather than robustly manifest, both the lay and professional reactions to the results tend to remain in abeyance.

Disregard for textbooks and careless examination are commonly found in company, yet I am sure imperfect examination rather than deficient academic information in the case of tonsillar troubles is the cause more largely responsible for those adverse effects on heart, joint, kidney,

lymph glands, lungs and even brain, which are so frequently cases of chronic toxic absorption from overlooked tonsillar sepsis. It is poor ground for gratification to feel that there are fewer tragedies from mass tonsillectomy than from misguided conservatism of septic tonsils following defective or careless examination.

It is surprising that a tonsillectomy inconsiderately recommended but never done is more liable to lead to fractious and uncomplimentary remarks from an irate parent or patient than the most unwarranted inaction in the case where dangerous tonsils had been exonerated though causing months or years of damage, and I have had more often to palliate such a criticism than to defend a conservative opinion where chronic lacunar sepsis had seriously or indeed permanently injured a patient's health.

The modern onslaught, which suggests a propaganda that the tonsils are an error of nature, has misled a large section of the public who put up their children for tonsillectomy as a matter of course and they feel disgruntled if their doctor differs with this view. In contrast to the majority, there are some who are difficult to convince that operation is the only way to safety. It is usually easy to demonstrate clearly or explain why tonsils require removal, a course which helps all concerned.

In India especially, where patients frequently go from one practitioner to another in an endeavour to obtain a majority opinion, it is a pity we could not all give the same advice, and since the supra-tonsillar fossa may take anything from a few days to some weeks to refill, it would be well to enquire when and how the last examination had been conducted.

The behaviour of the supra-tonsillar recess, or more correctly the intra-tonsillar fossa or lacuna magna, is the greatest source of error unless properly investigated. This inner or posterior end of the second branchial cleft is one of the few developmental remnants that is capable, in our stage of evolution at least, of doing much harm. It is the biggest culture and filter tube in the tonsillar immunizing scheme, but unfortunately too often refuses to empty or renew its contents, as it is situated in the upper end of an almost solid gland which is frequently hardened by fibrosis and uninfluenced by the pressure of deglutition, and has its mouth often covered by the anterior palatine fold or plica superior. The crypts are not so liable to this dysfunction, and less frequently can pus, either fluid or inspissated, be expressed from them in quantity and they yield much more freely to medical measures. The material seen bursting out of the crypts during removal of 'enlarged' tonsils, by the guillotine, is usually perfectly healthy and useful lymphoid tissue.

The following is a list of remarks for consideration before recommending tonsillectomy:—

1. *Size*.—Parenchymatous enlargement is usually a contra-indication unless so big as to



cause dysphagia or dyspnoea (I have only seen one case with dyspnoea, the patient was an undersized girl, aged 14 years). It would be an error to interfere with the physiological enlargement seen commonly in children of 4 to 6 years. Small tonsils may be much more dangerous than enlarged ones, fibrosis making them contract.

2. *Sepsis*.—Is it superficial, cryptic or lacunar, acute or chronic? Chronic lacunar sepsis with the intra-tonsillar fossa involved is the commonest indication for tonsillectomy. Some suggest that inspissated pus in the lacuna is harmless, but it cannot often remain permanently inspissated since liquefaction is one of the common properties of bacterial activity.

(a) The indications in chronic sepsis are more frequently to prevent or remedy remote effects rather than local discomforts, and cover the wide range of lesions due to chronic septic absorption.

(b) Recurrent attacks of superficial tonsillitis suggest operation especially when associated with local and less remote complications such as ear trouble, laryngitis, tracheitis, bronchitis or dyspepsia; the acute features being first encouraged to subside. Removal under this heading will also prevent the development of chronic lacunar sepsis and its acute manifestation—quinsy.

(c) Acute inflammation when simple or associated with the organisms or syphilis or Vincent's angina is best treated to begin with by medical measures.

3. *Age of the patient*.—The extremes of age require careful study. From 7 to 10 years is about the most suitable age for tonsillectomy, during this period the indications need not be so obvious as at other ages.

4. When faced with one of the long list of conditions reputedly due to or aggravated by septic absorption, the state of the tonsils and history of sore throats should be carefully investigated. Recently, the tonsils have again been incriminated as the direct origin of streptococci attacking the valves of the heart. The tonsils are often the portals of entry of tuberculous infection, which is first noticed as an adenitis of the glands of the neck. The presence of arthritis, fibrositis, neuritis, peptic ulcer, diabetes, anaemia, iridocyclitis and many others, invite examination of the tonsils and perhaps their removal at a time indicated by the general condition of the patient.

5. *Mobility*.—Diminished mobility usually indicates chronic sepsis with capsulitis and shortened lymph vessels. Closely wrapped pillars and plicae diminish mobility, so also does opening the mouth to its full extent.

6. *Prophylaxis of certain diseases*.—Tonsillectomy is useful against diphtheria and in curing carriers, but is not of much use in influencing acute rheumatism unless performed very early. Unhealthy tonsils should be removed early in pregnancy and before operations on the

stomach and air passages when urgency is not important.

7. *Intra-tonsillar calculi*.—These usually indicate tonsillectomy.

8. *Chemotherapy*.—The prontosil group of drugs are most useful in getting over the acute phases of inflammation but for the deep chronic infections, their use has limitations and cannot much influence the ultimate necessity of tonsillectomy.

9. *Carcinoma or sarcoma*.—When these are early and confined to the tonsil, dissection is sound, though radium alone is also used in malignancy. The size of the tumour is less important than its radio-sensitivity. Immediately the new growth extends beyond the capsule, the whole outlook changes for the worse and diathermy or radium or both are the only options.

A long list of 'T's and A's' would not appear to be a very carefully considered programme in many parts of the world. Especially in young children below the age of 6 or 7, one or other should be spared. Damp climate, city life, defective diet and hereditary influences, aetiological factors in excessive adenoid growth, do not always produce the same effects. (A very noticeable feature of general surgical conditions in India is the constant variation from place to place, a variation which must depend on factors more obscure than the usual aetiological causes of disease can explain.)

#### *Removal and recurrences*

Dissection is the method of greatest precision but it is classed as a major operation and requires a more specialized anaesthetic. The objections to the guillotine are that few cases are really suitable and that its proper use is difficult. When the tonsils are mobile and prominent (or a short anaesthetic is desirable) the guillotine is certainly the method of choice as under these conditions slicing and recurrence should be almost as infrequent as after dissection.

These recurrences of tonsillar tissue though they seldom give rise to more than local trouble, unless remnants of fossae are left behind, are a source of complaint and make a popular subject of topical conversation. An elementary explanation on the cause of recurrence without special reference to the nature of Waldeyer's ring usually leads to the naive confession—'Oh, I never knew that'. This admission, given in good faith, is made as if page 44 of the *British Encyclopædia of Medical Practice*, Vol. 12, was the only one that had been inadvertently overturned. Recurrences usually appear at the lingual end (where actual lymphoid tissue has to be cut through) and can follow dissection as well as the guillotine operation. I recently had the opportunity to mitigate the disappointment of a patient who had been operated on twice by a well-known London specialist.

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## AN INQUIRY INTO THE INCIDENCE OF PORPHYRINURIA

By A. D. JOSEPH, M.B., B.S.

(Assisted by V. P. GEORGE, B.Sc.)

(From the Miraj Medical Centre, Miraj, S. M. C.)

It was recently recognized that porphyria is an integral part of the pellagra syndrome and its presence can be used as an early objective test. It has been the observation of the medical consultants of the Miraj Medical Centre that larval forms of pellagra are occasionally encountered among the patients that pass through our clinic. In addition many cases are seen which present one or more manifestations of pre-pellagrous state, such as glossitis, angular stomatitis, atrophic condition of the lips, hyper-pigmented patches, especially over the buccal mucosa, cramping pains in abdominal and leg muscles, dermatitis, dry scaly atrophic condition of the skin, paræsthesia, chronic diarrhoea, fibrillary twitchings of muscles, etc. In most of these cases, we have observed that clinical improvement occurs on the administration of nicotinic acid and yeast, in adequate dosage.

This article is the result of an attempt to place our observations on a biochemical basis taking advantage of the fact that porphyria is an accompaniment of the pellagrous, or pre-pellagrous state. The work of Beckh, Ellinger and Spies (1937) has shown beyond doubt that coproporphyrin I or III is excreted in association with pellagra.

*Procedure.*—The urine of all the in-patients in the medical department of the Miraj Medical Centre was examined for porphyrin content. Detailed clinical examination of these patients was done to detect the presence of one or more symptoms constituting the pre-pellagrous state. Urine specimens from some of the medical students were also examined for porphyrin, to serve as controls. Those patients who showed porphyria were administered yeast and nicotinic acid, and the porphyrin determination in urine was repeated at regular intervals of a week or ten days, until porphyria disappeared or persisted in spite of yeast and nicotinic acid therapy. One and a half drachms of yeast and 6 to 9 grains of nicotinic acid were given by mouth in these cases daily. In cases

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When operation for chronic lacunar sepsis is refused or contra-indicated, I have found the almost daily application of equal parts of glycerine of carbolic, tincture of iron perchloride, and glycerine for some weeks if necessary, a useful method of diminishing size and improving drainage. The application should be pressed into the tonsils on cotton swabs. This does not cause that œdema of the mucous membrane which may follow the similar prolonged use of Mandl's paint, a reaction probably due to the iodine contained in this very popular and useful preparation.

of severe porphyria, nicotinic acid was also given by injection. The possibility of a pathological porphyria of an entirely different origin was not lost sight of and hence only these cases whose porphyria disappeared by nicotinic acid therapy were regarded as of pellagrous origin.

The technique employed in all cases was more or less the same as that described by Beckh, Ellinger and Spies. Ten c.cm. of urine is placed in a separating funnel and is acidified with 0.2 c.cm. of glacial acetic acid to produce a pH of 4.0. Twenty c.cm. of ether is added and the mixture is well shaken to extract the porphyrin completely. The lower aqueous layer is removed from the funnel and the ethereal extract is washed with 15 c.cm. of distilled water. Three c.cm. of 25 per cent hydrochloric acid is then added. The mixture is again shaken and transferred to a test-tube in which the acid and ether layers are allowed to separate. The hydrochloric acid is examined for porphyrin. No attempt at quantitative estimation was made since this was not needed for the present inquiry. However, results were expressed in five grades negative (—), doubtful (±), slightly positive (+), moderately positive (++) and strongly positive (+++) depending on the gradation of colour.

The urine of 12 medical students (to serve as controls) was also tested for porphyrin but gave negative results.

*Summary and conclusion*

(1) Eighty-two specimens of urine from the medical in-patients of Miraj Medical Centre were tested for porphyrin content.

(2) Fifty cases out of the total of 82 showed the presence of porphyrin, thus giving a percentage of 61.

(3) Thirty-four out of the 50 cases of porphyria showed one or more symptoms of pre-pellagrous state.

(4) Forty-five out of 50 cases of porphyria received yeast and nicotinic acid in adequate doses, after which decrease or absence of porphyrin excretion was demonstrated in 39 cases, indicating that the porphyria was evidence of pre-pellagrous state. Six patients did not show any decrease of porphyrin excretion in spite of nicotinic acid therapy. In the remaining five cases the effect of nicotinic acid and yeast could not be tried.

(5) Urine specimens from 12 apparently healthy medical students failed to show the presence of porphyrin.

(6) High porphyria was noticed mostly in cases of chronic enteritis and colitis, of atrophic cirrhosis of liver. The latter observation may throw light on the incidence and ætiology of cirrhosis of liver.

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## NOTES ON COMMON SKIN DISEASES

## IV. LEUCODERMA

By D. PANJA, M.B. (Cal.)

(From the Medical Mycology Enquiry under the Indian Research Fund Association in the School of Tropical Medicine, Calcutta)

LEUCODERMA is an acquired loss of pigment in the skin which manifests itself by the occurrence of ivory-white patches usually surrounded by normal or increased pigmentation. It is neither contagious, infectious, nor hereditary though at times there seems to be a familial tendency.

The race, age and sex have no relation with occurrence of the disease. The exact cause of leucoderma is not yet known; but it was found that there is evidence of intestinal derangement and the majority of the cases carry some infection in the intestine, protozoal, bacterial, or helminthic.

Apart from depigmentation the affected skin is not changed in any way; the activity of the sweat and sebaceous glands is not influenced, but the included hair shafts sometimes lose their pigment and become whitish or yellowish in colour; this condition of white hair is known as leucotrichia.

The patches are of various sizes and shapes, and can be classified into several types, e.g., the muco-cutaneous type affecting the lips, eyelids and external genitals; the pressure type affecting the waist as a result of the continuous pressure of the *dhoti*, *sari* or belt; the symmetrical type affecting both sides symmetrically; and the generalized type, where the white patches fuse to form large lobulated areas and even progress so far that the original complexion is obscured.

The lesions give rise to no subjective symptoms, but the whitened patches are hypersensitive to heat and light and tend to become inflamed readily when exposed to the sun. General health in leucoderma is not affected, though in sensitive persons considerable mental distress may be provoked. The affection may remain stationary for years and is generally slowly progressive in its course; in exceptional instances the patches disappear spontaneously.

The diagnosis of leucoderma is easy but it should be differentiated from partial albinism, pityriasis versicolor, leprosy, morphae, atrophic macular syphilide, dermal leishmaniasis, melano-leucoderma, and lupus erythematosus.

1. In *partial albinism* the lesions are congenital and there is no characteristic bordering of the depigmented patch by hyper-pigmented skin. In *partial albinism*, the patient has always a blue iris.

2. *Pityriasis versicolor* might lead to confusion but its identity is easily established by the absence of ivory-white depigmentation and the presence of slight scaling in the lesions, and also by the microscopical finding of the fungus in the scales.

3. There will be no difficulty in differentiating leucoderma from anasthetic *leprosy*, where the skin is lighter in colour and there are definite sensory changes that are not found in leucoderma.

4. In *morphae* the skin shows different grades of depigmentation with smooth, shiny, atrophic patches adherent to the underlying tissue.

5. *Atrophic macular syphilide* is a condition where multiple small atrophic areas are found on the trunk and extremities, and the atrophy is more marked than the depigmentation.

6. *Dermal leishmaniasis*, in its earlier stage, simulates leucoderma. But the lesions are not ivory-white, and, on the face round about the mouth, definite signs of granuloma are present. As a rule there is also a history of kala-azar or typhoid-like fever.

7. *Melano-leucoderma* generally affects the palms of the hands and the soles of the feet, and rarely the lips; it manifests itself by the appearance of patchy leucoderma and melanoderma (hyper-pigmentation) side by side, and also hyper-keratosis with desquamation. The hyper-pigmentation is more marked along the margins and sometimes extends higher up to the hands and feet. The disease is probably a late manifestation of syphilis, the serum reactions for syphilis are positive in all cases, and it responds to anti-syphilitic treatment.

8. The leucoderma-like depigmentation which is present in *lupus erythematosus* is due to cicatricial fibrous atrophy of the skin. Apart from depigmentation, the lupus patches are covered by the characteristic fine adherent horny plugs which, when removed, reveal enlarged follicular orifices. Moreover, the borders of the patches are markedly raised and infiltrated. These signs are absent in leucoderma.

*Treatment.*—The remark that 'no treatment has the slightest effect on leucoderma' in the textbooks of dermatology is not correct, as we have seen many cases responding with the following treatment:—

*General treatment.*—1. Careful investigation of the bowels by examining fresh stools for evidence of any intestinal infection.

(a) In the case of amœbic infection the treatment should first be directed towards the cure of this condition.

(b) If any bacillary (non-lactose-fermenter) infection is discovered, it should be treated by suitable autogenous vaccines, intestinal antiseptics and bacteriophage therapy.

(c) In the case of helminthic infection, the treatment should be given according to the nature of the infection.

2. There is nearly always evidence of irregularity of the bowels in leucoderma cases, so intestinal antiseptics should be given as 'a routine and liquor hydrargyri perchloridi (B.P.) in half to one drachm doses, twice daily after meals, is given for three to four weeks and is repeated after an interval of one to two weeks. The treatment is to be continued for three to six months or longer. Other intestinal antiseptics may also be tried.

3. *Diet.*—(a) Avoid highly spiced and stale food which may cause intestinal fermentation.

(b) Take germinating *gram*, beans and peas which are rich in vegetable protein and yield a good supply of tyrosin, a precursor of melanin.

4. Avoid pressure of the clothing on the site of leucoderma.

5. A change of climate is sometimes useful.

*Local treatment.*—1. Rub gently the oil of *bouchi* (*Psoralea corylifolia*) on the lesion twice a day for 5 to 10 minutes each time in order to cause a local stimulation of the melanoblasts.

The pigment begins to appear after a time, showing tiny spots on the margin of the patch or at the regions of the hair follicles.

*Certain practical difficulties in the use of the bouchi oil.*—(1) Sometimes the oil produces intense redness, burning and even vesication after a few applications and in susceptible persons the reaction may appear after a single application. In such cases the local application should be stopped at once and a soothing lotion, such as calamine lotion, should be applied on the patches several times every day until the redness and vesication subside. When the skin is normal, apply the oil again but diluted with olive oil, either 1 in 2 or 1 in 3 according to tolerance of the skin. In susceptible persons it is sometimes impossible to use the oil at all even in higher dilutions.

(2) In young children the diluted oil should be applied from the beginning.

(3) To certain tender parts, such as the muco-cutaneous junction of the lips, eyelids and external genitals, the diluted oil should be used.

2. Many years of experience of treating hundreds of cases at the Calcutta School of Tropical Medicine has led us to place our faith in external application of *bouchi* oil together with internal administration of intestinal antiseptics, but although persistence in this form of treatment is occasionally rewarded with success, partial or total failure has more often been the final result.

Recently, we have carried out a number of experimental treatments in which the oil, sterilized in an autoclave, has been injected intradermally instead of being rubbed on the skin.

*Method of treatment.*—The patch to be injected is carefully cleaned with alcohol, and the oil is injected intradermally with an ordinary hypodermic syringe fitted with a fine needle. The amount of oil in each injection is a single drop (between 0.05 and 0.1 c.cm.). The number of injections varies with the size of the depigmented patch, small spots of 1 cm. or so in diameter only need a single injection in the centre. In larger patches the injections are spaced about 1 cm. or a little more apart, until the whole area is covered. In two to three weeks, formation of pigment can be noticed, beginning at the site of the needle puncture from which point it spreads centrifugally. If when deposition of pigment ceases, the contiguous areas of new pigmentation have failed to coalesce, a second, and if necessary, a third, course of injections can be given in the intermediate white patches, until the whole area is normally pigmented once more. If the patch to be treated is several inches in diameter, and in consequence needs numerous injections to cover it completely, it has been found better to give a few injections fairly wide apart in the first instance and to follow with intermediate injections a few days later, than to try to cover the whole area at one sitting. The reasons for this modification

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## ON THE IMPORTANCE OF MALNUTRITION IN THE ÆTIOLOGY OF THE ANÆMIC STATE IN TEA GARDEN COOLIES\*

By K. P. HARE, M.B., B.S., L.M.S.S.A.

Hoogrijan, Assam

### Object and scope of the investigation

THERE is reason to believe that malnutrition plays an important part in the causation of the anæmic state which is so universal in the coolie population of the tea gardens of Assam. It is certain that this anæmic state is apparent among children of tender years and certain work has indicated that it may even be congenital. An investigation into the relationships between the effects of nutrition in children and hæmoglobin levels is, therefore, perfectly logical. Such dietary surveys as have been carried out among similar populations have shown that the chief defects in the dietary of the tea garden coolie are of animal protein, calcium and vitamins. The present investigation was designed to attempt an assessment of the relative importance of these three defects from the point of view of hæmoglobin level.

For this purpose a list was made of all births which had occurred on one estate during the years 1929 to 1934, inclusive, and enquiries were made as to what had happened to each of the children. It was found that 111 children (51 boys and 60 girls) born during those years were still alive and resident on the estate. These children were interviewed in batches and the following particulars recorded:—Age, height, weight, hip-width, arm-girth (with the forearm flexed and extended), chest-depth (in inspiration and expiration), the existence of stigmata of hypovitaminosis, and the amount of hæmoglobin in grammes per 100 c.cm. of blood. For the last, the Sahli hæmoglobinometer was used. In each case, from the arm, chest and hip measurements, the ACH index was calculated and compared with the standard as modified by Aykroyd to suit small hip measurements.

\* Based on a note read at the 1941 Assam Provincial Medical Research Conference.

(Continued from previous column)

are that injections are followed by a good deal of pain, and if many are given at one time the pain is very severe, and also injection of the oil is sometimes followed by a small focal ulcer which remains small if the injections are wide apart; but, if several of these ulcers were to occur in adjoining injection sites, they might coalesce and form a relatively large lesion. It should be noted, that apart from the extra discomfort at the time and the subsequent scarring, ulceration has no ill effects on the final result as the scar always becomes pigmented.

### General observations

Though a very large proportion of the children were obviously under-nourished, only six were 'selected' by the ACH system, a percentage of 5.4. This unreliability of the system for use in India without further modification has been commented on by other workers and is presumably due to malnutrition affecting muscular and skeletal development fairly equally so that all measurements are small.

The number of children showing stigmata of hypovitaminosis together with the mean hæmoglobin level of each category will be found in table I. In this instance, age groups have been ignored because it will be apparent from later tables that there was little correlation between hæmoglobin and age and, in fact, only two age groups among the girls and one among the boys had mean hæmoglobin values higher than the mean hæmoglobin value of the children without stigmata. There was a slight but definite defect of hæmoglobin in those children who showed evidence of present hypovitaminosis but this was not the case in those whose previous lack of these substances had been righted.

TABLE I

*Correlation between stigmata of hypovitaminosis and hæmoglobin level*

Category	Number in category	Mean hæmoglobin value in category
No stigmata ..	59	7.20 g. per 100 c.c.
Healed xerophthalmia only ..	3	7.00 do.
Phrynodermia only ..	11	6.99 do.
Xerophthalmia only ..	29	6.96 do.
Phrynodermia and xerophthalmia.	9	6.98 do.

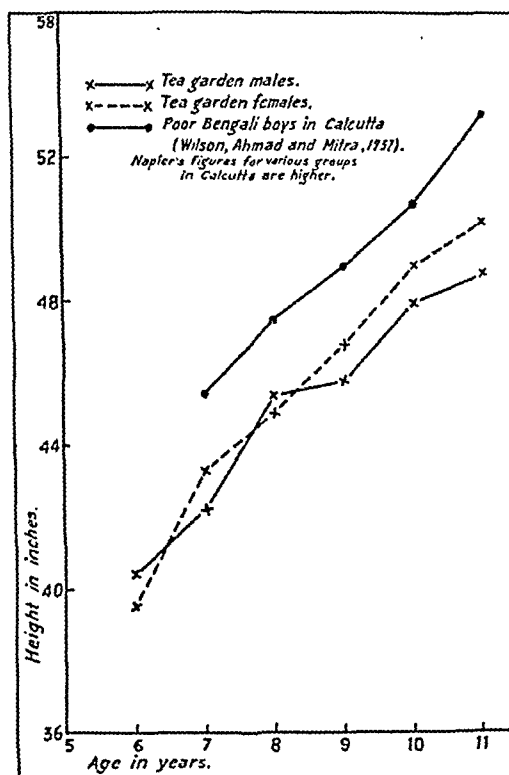
The height-for-age and weight-for-age were both lower than in any series I have seen recorded for India. Details are recorded in graphs 1 and 2.

Details for the hip-width-for-age are recorded in graph 3. It will be seen that a very exact correlation existed between these two variables.

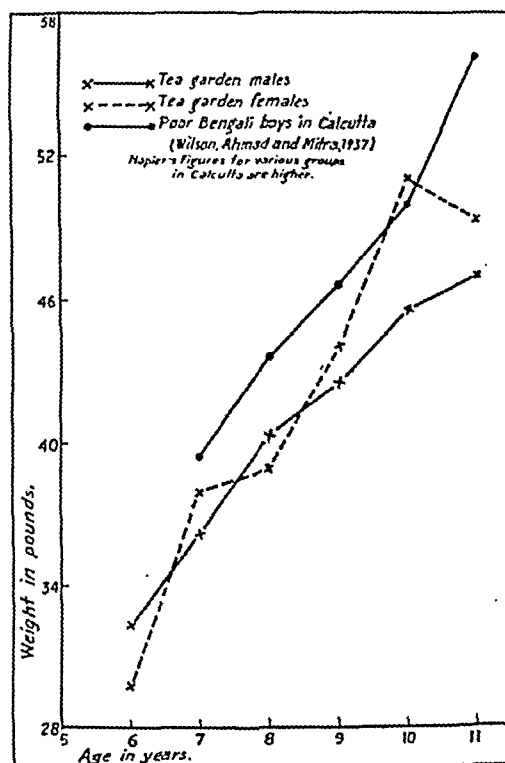
Graph 4 illustrates in graphical manner the mean hæmoglobin content of the blood of boys and girls in this series according to the year of birth. It will be seen that there is only slight correlation between age and hæmoglobin content in marked contra-distinction to that noticed in the other three graphs. I am unable to offer any explanation of this fact. One interesting fact emerges. The hæmoglobin content of the blood of the average healthy adult tea-garden coolie has been previously shown to be slightly lower than three-quarters of that of healthy Calcutta adults. In this series the hæmoglobin content is slightly less than that of Calcutta children of the same age examined by Napier and Das Gupta (1940).

### Correlation of measurements with hæmoglobin content

In tables II to VI are recorded the mean hæmoglobin contents for both sexes in each age



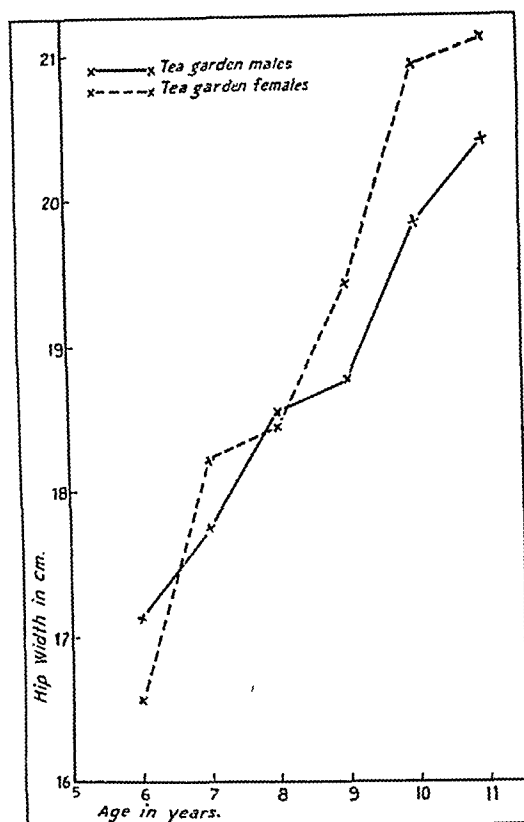
Graph 1.—Height-for-age.



Graph 2.—Weight-for-age.

group of those whose measurements are below and above the average for the group. The only measurements which demonstrated any degree

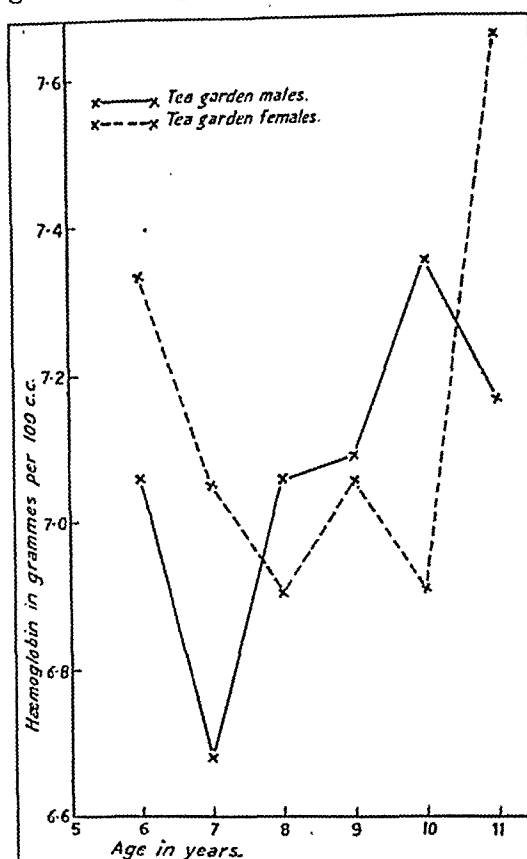
of correlation with hæmoglobin (and in both cases the correlation was poor) were height and arm-girth. The latter finding suggested that muscular development, which is presumably dependent on animal protein intake, might be investigated more closely.



Graph 3.—Hip-width-for-age.

Now it had been noticed during the course of the investigation that the chest-depth was not a highly variable factor in these children. Given this fact, it is obvious that the size of the ACH index in children with similar hip-widths will vary directly with the arm-girth. If then, hæmoglobin production is most largely dependent on animal protein intake, in any group of

children with the same hip-width, those with the greater arm-girth should be more richly



Graph 4.—Hæmoglobin for age.

Note.—The average values for both sexes are slightly lower than 3/5 of those for corresponding age groups in Calcutta as determined by Napier.

endowed with hæmoglobin than those whose arms are smaller. A reclassification of the children on these lines resulted in the figures quoted in table VII. There is certainly a greater degree of correlation between the size of the ACH index and hæmoglobin content than was seen in any of the other tables but I do not consider it sufficient to be convincing.

TABLE II  
Correlation between height and hæmoglobin level

Age in years	MALES		FEMALES		CORRELATION BETWEEN HEIGHT AND HÆMOGLOBIN	
	Mean hæmoglobin of those		Mean hæmoglobin of those			
	above average height	below average height	above average height	below average height	Males	Females
6	7.27	6.76	7.37	7.28	+	+
7	6.84	6.40	7.00	7.12	+	—
8	6.95	7.15	6.87	6.92	—	—
9	7.13	7.05	7.47	6.75	+	+
10	7.80	6.80	6.69	7.13	+	—
11	7.07	7.30	7.80	7.53	—	+

TABLE III  
*Correlation between weight and hæmoglobin level*

Age in years	MALES		FEMALES		CORRELATION BETWEEN WEIGHT AND HÆMOGLOBIN	
	Mean hæmoglobin of those		Mean hæmoglobin of those			
	above average weight	below average weight	above average weight	below average weight	Males	Females
6	7.03	7.10	7.71	7.17	—	+
7	6.73	6.50	7.13	6.96	+	+
8	7.00	7.10	6.94	6.80	—	+
9	7.10	7.06	7.47	6.75	+	+
10	6.80	7.63	6.69	7.13	—	—
11	7.00	7.28	7.56	7.72	—	—

TABLE IV  
*Correlation between hip-width and hæmoglobin level*

Age in years	MALES		FEMALES		CORRELATION BETWEEN HIP- WIDTH AND HÆMOGLOBIN	
	Mean hæmoglobin of those		Mean hæmoglobin of those			
	above average hip-width	below average hip-width	above average hip-width	below average hip-width	Males	Females
6	7.32	6.80	7.32	7.33	+	—
7	6.53	6.76	7.20	7.00	—	+
8	7.00	7.08	6.87	6.92	—	—
9	7.40	6.82	6.90	7.27	+	—
10	7.80	7.00	6.80	7.01	+	—
11	7.00	7.28	8.10	6.95	—	+

TABLE V  
*Correlation between chest-depth and hæmoglobin level*

Age in years	MALES		FEMALES		CORRELATION BETWEEN CHEST-DEPTH AND HÆMOGLOBIN	
	Mean hæmoglobin of those with chest-depth		Mean hæmoglobin of those with chest-depth			
	above average	below average	above average	below average	Males	Females
6	7.03	7.10	7.45	7.26	—	+
7	6.80	6.60	7.20	6.97	+	+
8	6.90	7.10	7.02	6.73	—	+
9	7.30	6.90	6.84	7.60	+	—
10	7.08	7.70	6.71	7.12	—	—
11	7.07	7.30	7.60	7.68	—	—

TABLE VI  
Correlation between arm-girth and hæmoglobin level

Age in years	MALES		FEMALES		CORRELATION BETWEEN ARM-GIRTH AND HÆMOGLOBIN	
	Mean hæmoglobin of those with arm-girth		Mean hæmoglobin of those with arm-girth			
	above average	below average	above average	below average	Males	Females
6	7.16	6.99	7.40	7.24	+	+
7	7.07	6.44	7.06	7.05	+	+
8	7.15	6.95	7.02	6.73	+	+
9	6.94	7.25	6.90	7.27	—	—
10	7.00	7.64	6.87	6.98	—	—
11	7.00	7.28	7.80	7.53	—	+

TABLE VII  
Correlation between ACH index and hæmoglobin level

Hip-width in cm.	MALES		FEMALES		CORRELATION BETWEEN ACH INDEX AND HÆMOGLOBIN	
	Mean hæmoglobin of those with ACH index		Mean hæmoglobin of those with ACH index		Males	Females
	above average	below average	above average	below average		
15-16.9	7.00	6.90	7.55	6.87	+	+
17-17.9	7.37	6.50	6.72	6.90	+	—
18-18.9	6.83	6.83	7.13	7.44	0	—
19-19.9	6.75	7.40	7.00	6.72	—	+
20-20.9	7.67	7.20	7.13	7.50	+	—
21-21.9	7.00	7.87	8.00	7.60	—	+
22-22.9	..	..	7.87	7.53	..	+
23-25.9	..	..	6.40	5.20	..	+

### Conclusions

It is probable that various vitamins, animal protein and calcium are, in the sense of defective intake, all important in the aetiology of the anæmic state of the tea garden coolie. The present investigation has failed to indicate any one as being of special importance but has suggested that their relative importance may be in the order vitamins, protein and calcium.

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### THE BENZIDINE REACTION OF BLOOD SIMULATED BY A CLAY (BENTONITE)

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THE intention is to draw attention to a reaction with benzidine (para-diamino-diphenol) given by a clay known as bentonite.



The benzidine test detects blood in traces a dilution of 1 in 300,000. It is best performed thus: to a small cutting or scraping of the stain placed on a white dish are added a drop of a saturated solution of benzidine in glacial acetic acid and a drop of 3 per cent hydrogen peroxide; a brilliant blue coloration develops immediately (Lloyd, 1935). The basis of the reaction is the oxidation of the benzidine by oxygen liberated from the peroxide by a peroxidase present in hæmoglobin or its derivatives.

That fruits and vegetable juices, particularly the potato juice, also provide the oxidase for the oxidation of the benzidine is known. That the plant juice contains auto-oxidizable substances of a phenolic nature which are capable of combining directly with atmospheric oxygen to form organic peroxides from which oxygen is readily transferred to an oxidizable substance by a peroxidase present in the same juice, is also known (Parsons, 1933).

The clay bentonite has also been found to react with benzidine. It reacts like the plant juice containing the auto-oxidizable substances and also like the potato juice. The scrapings from its exposed surface turn the benzidine greenish blue, even in the absence of hydrogen peroxide. The same scrapings after the removal of (loosely bound?) oxygen, by submersion in an excess of physiological saline overnight, cease to affect the benzidine in the absence of the peroxide: the coloration now develops only on the addition of the latter reagent. The scrapings after they have been dried and exposed to air react without hydrogen peroxide again.

The clay does not give the reaction of thallium with benzidine.

The initial chemical reaction of the clay, although slower than that of blood, creates a presumption in favour of presence of blood. The presumption is not disposed of until a negative spectroscopic test is obtained. This simulation of the reaction of blood by an inorganic substance, even at only one step of the routine, is recorded in the interest of forensic chemistry.

The writers are indebted to the Geological Survey of India, Calcutta, for the identification and the following brief description of the clay:—

‘Bentonites are clays that have the clay mineral “montmorillonite” with the chemical composition of  $(\text{MgCa})\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 5 \text{SiO}_2 \cdot n\text{H}_2\text{O}$ , for their chief constituents. These clays are of very small grain size and absorb large quantities of water, swelling enormously in the process, and they have the property of remaining in suspension in their water dispersions.

The swelling property is reversible; the clay can be dried and re-swelled an infinite number of times; this activity remaining unaffected by temperatures below  $450^\circ\text{F}$ . It can be readily distinguished from other clays by its reaction with benzidine.

Uses.—Bentonites are used in metal foundries as a bonding material for moulding sands, in drilling muds, as a detergent in the laundry, as a plasticizing agent in ceramic materials, as a standard suspending, spreading and adhesive agent in horticultural sprays and

(Concluded at foot of next column)

## STUDIES ON *LEPTOSPIRA ICTERO-HÆMORRHAGIÆ* IN RATS IN BOMBAY CITY

By M. N. LAHIRI

(From Haffkine Institute, Bombay)

ACCORDING to Ido, Hoki, Ito and Wani (1916 and 1917) it was Miyajima who first drew attention to the finding of spirochætes resembling *Leptospira icterohæmorrhagiæ* in the kidneys of the field mouse. The discoverer subsequently reproduced the disease in the guinea-pig by inoculation of the infected kidney of the field mouse. These workers, acting on this suggestion, examined a number of wild rats. The presence of similar spirochætes were detected in the kidney or urine of the rats and were also demonstrated by means of guinea-pig inoculations. Since then, investigations have been carried out in different parts of the world by different workers. High prevalence of infection among rats has been observed both in places where human cases have been known to have occurred and in places where the disease in man is unknown. Langworthy and Moore (1927), for instance, detected a high incidence of the infection among rats in the New York State, 40 per cent by direct examination and 60 per cent by serological tests, and yet as far as is known no human cases have been reported from that area.

(Continued from previous column)

insecticides, in clarifying turbid waters and purifying sewage, in gelatinizing wet-mash poultry foods, for clarifying wines, in cosmetics, and pharmaceuticals.

The original specimen of the clay which was found to react with benzidine was an exhibit designated ‘stone’ in a murder case. Other specimens resembling it in appearance, consistency and reaction were obtained from the aforesaid department. It was a compact lump of a bluish-white substance which could be easily scraped and ground.

The use of the clay in cosmetics is worthy of note. A brand of talcum powder was found to react with benzidine. It is also noted that the reaction between benzidine and bentonite is known to geologists.

### An acknowledgment

The writers are indebted to V. P. Sondhi, Esq., M.B.E., M.Sc., F.G.S., of the Geological Survey of India, Calcutta, for the aid received.

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Anderson and Wagle (1933) first pointed out the existence of infection in rats in the city of Bombay. The present investigation was undertaken to carry out a systematic examination of rats not only to demonstrate the infection but also to isolate and identify the strains with particular reference to their serological classification. Because, if the murine strains and human strains when obtainable are serologically identical, it might throw some light on the possibility of the rat playing a part in the transmission of the disease. For this purpose, rats from a particularly congested area of this city were trapped and brought alive to the laboratory. In all a series of 125 rats was examined.

### Methods

1. *Direct examination.*—It has been shown by several workers that the leptospiræ in rats are confined to the convoluted tubules of the renal cortex where they are discretely localized. Therefore, major portions of the cortex of both the kidneys from each animal were emulsified in sterile normal saline and care was taken to break up the tissues thoroughly. The emulsion thus prepared was examined by dark-ground illumination. Three preparations were examined before returning a sample as negative.

2. *Animal inoculation.*—As a measure of economy it became necessary to pool the kidney emulsions of three or four rats in which leptospiræ could not be detected by dark-ground illumination. Three c.cm. from each of the mixtures thus made were inoculated intraperitoneally into a young guinea-pig, whereas in those emulsions showing leptospiræ a separate guinea-pig was used in each case for the infective material. The peritoneal fluids of the guinea-pigs were aspirated and examined on the 4th, 6th and 7th day after inoculation for the presence of leptospiræ. As a rule, the animals were kept under observation until six weeks after inoculation.

3. *Culture of the kidney cortex.*—Small pieces of the tissue were inoculated into Vervoot's medium and incubated at room temperature (21° to 29°C.). The cultures were examined regularly at intervals from the 8th day onwards to the end of three weeks after inoculation.

4. *Serological testing of the rat's serum.*—As soon as the rat was killed by means of chloroform the chest wall was opened aseptically and blood was collected from the heart with a fine capillary pipette. The rat's blood in general clots very quickly after death. The sera of rats were tested for the presence of agglutinins and lysins against a classical strain of *L. icterohæmorrhagiæ* kindly supplied by Dr. B. M. Das Gupta of the School of Tropical Medicine, Calcutta. Varying dilutions of each serum ranging from 1 in 10 to 1 in 80 were first made. An equal volume of rich young live culture in Vervoot's medium was added to each of the dilutions of the serum. The final dilutions of the serum, therefore, were 1 in 20 to 1 in 160. As a control, rabbit or normal human sera in dilution of 1 in 10 was used. The tubes were incubated at 37°C. for 2½ hours and at the end of this period samples from each tube beginning from the highest dilution of serum were examined by dark-ground illumination. Further dilutions were not necessary except in only one instance when dilutions up to 1 in 640 had to be made.

### Observations

1. The leptospiræ were demonstrated in only eleven specimens of the kidney emulsions examined by dark-ground illumination. Incidental to the search for leptospiræ in these animals it will be of interest to record that *Trypanosoma lewisi* were seen in the blood of five rats.

2. Forty guinea-pigs were inoculated with the kidney emulsions. These animals may be arranged in the following groups:—

(a) Ten guinea-pigs were injected with infective material positive by the above method. One specimen, although it showed leptospiræ, could not be inoculated as guinea-pigs were not available. Of these ten, four failed to show any evidence of leptospiral infection and remained alive and well during the observation period. Four animals succumbed to the infection with typical signs, from the culture of the heart's blood of three animals, strains of leptospira were obtained. With regard to one the animal died late in the night hence its liver emulsion showing numerous leptospiræ was inoculated into a second animal for the isolation of the strain which, however, did not show any evidence of infection. A month later, far beyond the usual fatal period, this animal received a massive inoculation with heavily infected guinea-pig liver, but it remained insusceptible to infection. In the remaining two animals, although they died within the usual fatal period, there was no jaundice, and characteristic lung hæmorrhages as well as hæmorrhages in the groin were the visible signs of infection. No leptospiræ were seen either in the body fluids or in any organs. Buchanan (1927) also recorded similar findings in his studies.

(b) Of the remaining thirty animals which received the pooled emulsion only two died of infection and at autopsy exhibited the complete picture of the disease. The heart's blood collected almost immediately after death was cultured and thus two strains of leptospira were obtained. This brings out an important fact that, if only very few leptospiræ are present in the kidneys, an infected rat may escape detection by the direct method but infection can be demonstrated by animal inoculation.

3. Kidney substance of seventy-eight rats was cultured. In all twenty-seven were free from bacteria of which only two gave a pure growth of leptospira. The positive cultures obtained were, however, from rats which showed leptospiræ in their kidneys. The rest showed bacterial growth and in several instances a motile organism was isolated which on culture was identified as *Bact. pseudo-asiaticum*. Evidently, the rats had this bacterial infection. Das Gupta (1940) also reported similar heavy infections with salmonella-group organisms among rats in Calcutta.

4. Sixty-eight samples of sera were examined of which only six gave positive reaction. Four samples reacted in a dilution of 1 in 20 and one in a dilution of 1 in 80. The sixth sample agglutinated up to a titre of 1 in 640. Of these six positive specimens four were collected from the animals in whose kidneys leptospiræ were seen. It is difficult to draw any conclusion from such a low titre. It may be coagglutinins or that the serological properties in rats may persist only for short periods. With titre of 1 in 80 it

is possible that the rat was infected with the classical strain whilst the titre of 1 in 640 is definitely suggestive of infection.

The five strains of rat leptospira recorded above, all reacted up to the full titre with anti-leptospiral serum (classical).

#### Comment

From the above studies it is evident that the dark-ground method of examination yields the best results for the demonstration of infection. But for the purpose of isolation of the organism either the kidney cortex must be cultured or an emulsion of the ground-up kidney tissues inoculated into a guinea-pig. As regards culture, although a large number of positive results have been recorded by many observers, in my experience the results were far from satisfactory. This was in most instances due to the simultaneous infection by *Bact. pseudo-asiaticum* in rats, already referred to.

With regard to the animal inoculation, it may be mentioned that the method has obvious advantages. Even infected rats which may escape detection by the direct method when scanty leptospiræ are present often show infection by this method. But the drawback is that in certain guinea-pigs the disease could not be reproduced. It may be either due to variations in virulence of the organism or due to individual resistance towards susceptibility to infection. Observation recorded under animal inoculation lends strong support to the later contention. Several workers by means of serological tests have demonstrated infection in rats and some investigators reported the titre to be very high. It is shown, however, that in the series most of the infected rats reacted in a very low titre, whereas positive reactions were obtained in two rats not carrying leptospiræ. These observations, therefore, confirm the findings of Zimmermann (1930). Thus, the importance of the combination of various methods is stressed.

#### Summary

The kidney cortex of one hundred and twenty-five rats trapped in one congested area of the city were examined by dark-ground illumination and by animal inoculations. Seventy-eight specimens of kidney tissues were cultured in Vervoor's medium. Sixty-eight samples of sera were tested for the presence of agglutinins and lysins.

Leptospiræ were detected in the kidneys of eleven rats by direct method and of only two by animal inoculations. Two other animals showed evidence of infection serologically. The rats found to be infected by the above methods were all of the species *Rattus norvegicus* except one which was of the species *Rattus rattus* and whose serum was found to contain anti-leptospira agglutinins with a titre of 1 in 640. The five strains of rat leptospira isolated all belong to the classical group.

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## OBSERVATIONS ON THE RELATIONSHIP BETWEEN MALARIA AND PISTIA IN TWO VILLAGES IN MURSHIDABAD DISTRICT

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and

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ONE of the writers (P.C.R.) during the course of his duties as health officer of Murshidabad district has made extensive observations since 1928 on the epidemiology of malaria in relation to the presence of pistia and finally applied the results to practical tests in several isolated highly endemic localities in the district. From the success obtained by systematically removing pistia from the breeding places, he concluded that malaria and pistia were inter-related at least in the district of Murshidabad.

He suggested that mosquitoes bred out from larvæ which have opportunities to feed on pistia become susceptible to plasmodial infection. According to him, excepting *Anopheles subpictus* and *A. vagus*, any and every anopheline mosquito breeding in association with pistia is dangerous to the community. It should, however, be recalled that it is not known whether larvæ really feed on pistia.

Laboratory experiments, on the other hand, conducted by one of the writers (D. N. R.) with *A. stephensi*, showed no difference whatever in the comparative infectivity in two samples, one bred out with pistia and the other without it. In these experiments larvæ were collected in nature and were not reared from eggs.

It is known that mosquito larvæ are dependent for their breeding chiefly on the ecological conditions of the water which are set up by

(Continued from previous column)

#### Acknowledgment

My grateful thanks are due to Dr. B. M. Das Gupta, Officiating Professor of Protozoology, School of Tropical Medicine, Calcutta, for his kind help and suggestions.

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plants and animals. The association of these two factors plays an important rôle in the development and sustenance of flora and fauna of a water reservoir and the parts played by them are interdependent.

It was therefore the object of our research to determine the part played by this particular plant *Pistia stratiotes*, in the reduction of the local malaria-carrying anopheles.

As there was no information available on the particular species responsible for malaria in that locality, it was necessary to approach the subject from another direction by noting the improvement brought about mainly in the spleen indices, mortality rates, etc., by anti-pistia measures.

The local operations were conducted by the junior writer at the advice of the senior.

Two villages were selected for this study. In the first, pistia which was usually present in abundance in many tanks was removed and, except pistia, as far as possible other types of vegetation were not disturbed. When removal of pistia caused denudation of nearly all vegetation, other plants mainly salvinia and hyacinth were introduced. In a neighbouring village, Ranagram, situated at a distance of two furlongs from Khosbaspur, pistia was alone allowed to remain while other weeds

such comparative data have been shown in table II. In a population undergoing quininization the spleen and average spleen rates are more markedly affected than the average enlarged

TABLE I  
Spleen rates before and after anti-pistia operations

Time of the year	Khosbaspur (pistia was removed and other plants introduced)	Ranagram (only pistia was allowed to remain)	REMARKS
July 1939 ..	41	2.7	This shows a great reduction of the spleen rate in one and an increase in the other village.
December 1940	16	22.6	

spleen (Christophers, Sinton and Covell, 1928). No such quininization, however, took place in these two villages except the usual medical aid received by both from the neighbouring dispen-

TABLE II  
Average spleen rate and average enlarged spleen

Time of the year	AVERAGE SPLEEN RATE, CM.		AVERAGE ENLARGED SPLEEN, CM.		REMARKS
	Khosbaspur	Ranagram	Khosbaspur	Ranagram	
July 1939 ..	1.905	0.054	4.650	2.0	No corrections for height have been made.
December 1940 ..	0.520	0.948	3.250	4.181	

were eliminated. Except for pistia, the conditions in the two villages were more or less identical.

Tanks and ricefields were potential sources of anophelines in the two localities.

The population in Khosbaspur and Ranagram were 1,116 and 592 during the experimental period and the areas covered by them were 774 and 677 acres respectively.

The observations were carried out from July 1939 to December 1940, and as the malaria incidence generally attains its peak in November and declines in June, this period included two malaria seasons.

The difference in the spleen rate of these two villages, Khosbaspur and Ranagram, from 1939 to 1940, i.e., before and after anti-pistia measures were undertaken, are shown in table I.

As improvement brought about by any anti-malaria measure can be better judged from 'average spleen' and 'average enlarged spleen',

sary at Gokarna. Lest this factor might interfere with the results, even the normal annual quinine supply to this Union Board was stopped.

TABLE III  
Total deaths and deaths per mille

Time of the year	Khosbaspur	Ranagram	REMARKS
January-June. } 1938	13	6	Total population of Khosbaspur and Ranagram were 1,116 and 592 respectively.
July-December. }	42	8	
January-June. } 1940	11	6	28
July-December. }	9	11	

Total deaths, particularly total fever deaths, are given in tables III and IV.

TABLE IV  
*Total fever deaths actual and per mille*

Time of the year	Khosbaspur	Ranagram	REMARKS
January-June. } 1938	6 } 43	6 } 20	
July-December. }	42 }	6 }	
January-June. } 1940	5 } 12	6 } 27	
July-December. }	8 }	10 }	

Infant mortality under 1 year of age and the number of children born are shown in tables V and VI.

TABLE V  
*Infant mortality under 1 year per mille*

Time of the year	Khosbaspur	Ranagram	REMARKS
January-June. } 1938	7 } 652	1 } 66	
July-December. }	8 }	0 }	
January-June. } 1940	0 } 130	0 } 200	
July-December. }	3 }	3 }	

TABLE VI  
*Births*

Time of the year	Khosbaspur	Ranagram	REMARKS
January-June. } 1938	15 } 23	10 } 15	In Khosbaspur there was an increase in autumn births. In Ranagram it was nearly the same during the two periods, spring and autumn.
July-December. }	8 }	5 }	
January-June. } 1940	7 } 29	11 } 23	
July-December. }	22 }	12 }	

An examination of the data presented above clearly reveals that in Khosbaspur there was a marked improvement in the health of the population after pistia was removed, whereas a deterioration was noticed in the other village where pistia was allowed to grow freely. We will now adduce evidence in support of the fact that pistia had a direct bearing on the fluctuation of malaria in the two localities.

(1) The increase of malaria in other places in the district, especially in the neighbouring villages, during the same period.

(2) Its decline in autumn in a pistia-free area when a rise is the rule.

The spleen indices of a few neighbouring villages tabled below reflects the condition of health as regards the incidence of malaria in the rest of the district and it can be stated that 1940 was a particularly bad year for malaria. Under these circumstances the reduction of malaria in pistia-free places must be directly associated with the particular operations undertaken in the locality.

TABLE VII  
*Spleen rates of some neighbouring villages*

Places	Distance from Khosbaspur	SPLEEN RATE	
		1938 December	1940 December
Gobarhati ..	3 miles	40	80
Patanda ..	3 miles	60	100
Mahalandi ..	3 miles	50	70
Gokarna ..	$\frac{1}{2}$ a mile	10	46

During autumn, the epidemic season, there is always a tendency for the spleen rate to rise. When such variation of the spleen rates in the two experimental villages given in table VIII is compared, it is noticed that while an autumnal rise is recorded in the one, there is a gradual decline of the spleen rate in the other. This suggests that the local operations are directly responsible for preventing the spleen rate from rising in autumn in the pistia-free village.

TABLE VIII  
*Seasonal and non-seasonal variations of the spleen rate and average spleen*

Time of the year	SPLEEN RATE, CM.		AVERAGE SPLEEN, CM.	
	Khosbaspur	Ranagram	Khosbaspur	Ranagram
June 1939 ..	41.0	2.7	1.905	0.054
December 1939 ..	34.8	10.0	1.25	0.314
June 1940 ..	21.7	9.0	0.851	0.337
December 1940 ..	16.0	22.6	0.52	0.948

Whether the rapid reduction of the spleen rate in the experimental villages from 41 in July 1938 to 16 in December 1940, would or would not have resulted, if the flora in the different breeding places were not interfered with, may now be discussed. The spleen rates of two villages, Khosbaspur and Laharpara, collected by Sinha (1940) may throw some light on this point. He carried out similar anti-pistia experiments and these two localities in the same district were used by him as controls.

Showing the natural fluctuation of spleen rates as compiled by Sinha.

Time of the year	Khosbaspur	Laharpara	REMARKS
July 1933 ..	1.4	24.1	Flood, 1934.
November 1933 ..	7.2	24.3	
June 1934 ..	3.4	22.9	
November 1934 ..	10.1	8.3	Drought, 1935.
July 1935 ..	8.8	5.4	
November 1935 ..	0.7	0.0	Drought, 1936.
July 1936 ..	1.6	1.6	
January 1937 ..	2.1	2.5	
June 1937 ..	2.1	0.0	
October 1937 ..	3.0	0.0	
January 1938 ..	16.3	0.0	
June 1938 ..	4.7	0.0	
December 1938 ..	54.5	7.0	

The above findings indicate that under certain circumstances the spleen rate may normally fluctuate within narrow limits. But due consideration should be paid to the operation of such abnormal conditions (flood and severe drought, during 1934, 1935 and 1936), on the epidemiology of the disease. In contrast to the usually small degree of fluctuation noticed under normal conditions, the decline of the spleen rate resulting from anti-pistia measures is marked and rapid. This is also very well exemplified by the following records compiled by Sinha in a neighbouring hyperendemic locality during the period anti-pistia operations were in existence.

The nature of the decline of spleen rate in Munigram in course of anti-pistia operations (Sinha)

Time of the year	Spleen rate	REMARKS
July 1933 ..	87.5	Before removal of pistia.
November 1933 ..	83.3	After removal of pistia.
November 1934 ..	63.2	
November 1935 ..	26.5	
October 1937 ..	6.6	
December 1938 ..	1.7	

The rise of the spleen rate in the one and its corresponding decline in the other cannot therefore be correlated with any other factor except pistia. It seems illogical to select two places so near to each other for the demonstration of the effect of pistia on malaria knowing that normally mosquitoes can fly a longer distance than two furlongs. However, the observations recorded by Sweet and Rao (1934) in connection with malaria control in Mysore State may be equally applicable in our case. Although the control operations were confined to Bangalore City where a sharp drop of malaria was noticed, in the adjacent civil and military stations outside the control area there was evidence of an increase.

At the time this experiment was undertaken it was contemplated studying the comparative

difference in the numerical ratio of adult and larval anophelines in the two localities. Unforeseen circumstances interfered with this plan. Although it has not been possible to determine the local carrier species, a strong suspicion rests on *A. philippinensis*, even though Sinha recorded only one adult and we found none.

The success of an anti-malaria measure is universally judged by the improvement of the health of the population manifest in the reduction of the spleen rate, average spleen, more especially average enlarged spleen, etc. It must therefore be admitted that there is a strong case in favour of pistia. It is not, however, possible to answer at this stage whether the improvement that has been noticed following the removal of pistia is merely temporary, although the junior writer claims that he has to his credit other areas in the same district which have been kept almost free from malaria for a number of years by systematically removing pistia.

According to Sinha (1940) general weed removal is more responsible for the improvement than the removal of pistia alone. It has already been pointed out that in Khosbaspur other plants, e.g., hyacinth and salvynia, were introduced into tanks from where pistia was removed and in Ranagram pistia was allowed to grow more freely by eliminating other plants.

The coexistence of a particular type of vegetation and *A. philippinensis*, which is possibly the local vector, has been emphasized by Bose (1934). On the breeding habits of this mosquito in an adjacent district Bose remarked 'in two of the clean tanks at Birnagar, we attracted them by introducing certain kinds of vegetation and repelled them by removing the same vegetation' and 'even when tanks are re-excavated, *A. philippinensis* recommences to breed in them as soon as certain kinds of vegetation reappears'.

The association of a particular species of mosquito with pistia is very well known; a few examples may be cited to illustrate this. Mieldazis (1930) reported the coexistence of *A. philippinensis* and pistia in the Philippine Islands. Kariadi (1938) noted a definite correlation between *Mansonia uniformis* and *Eichornia* and between *M. annulifera* and pistia in the Netherlands East Indies. Both Leeson (1937) and Evans and Garnham (1936) recorded the intimate association between the breeding of *Anopheles rivulorum* var. *garnhamellus* and the existence of *Pistia stratiotes* in East Africa, South Rhodesia and Kenya. Rozeboom (1935) found *A. bachmanni* usually in patches of pistia. Although *Ficalbia minima* are free-living and do not depend on pistia for their supply of oxygen, they were never seen by Iyengar (1935) in the absence of this plant.

#### Summary

Epidemiological studies on the relationship between pistia and malaria have been carried



out in two villages in the district of Murshidabad (Bengal). In one of them pistia was removed from tanks which are the potential sources of anopheline mosquitoes and in its place other vegetation was introduced. In the other village all vegetation except pistia was removed. At the end of two malaria seasons a progressive and at the same time a marked decline of malaria was noticed in the former village and a corresponding increase in the other. The association of a particular type of vegetation with the breeding of *A. philippinensis* in a neighbouring district has previously been reported.

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## A Mirror of Hospital Practice

### EYE COMPLICATIONS OF DERMAL LEISHMANIASIS

By L. EVERARD NAPIER, F.R.C.P. (Lond.)  
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MOHI UDDIN, male, aged 20 years, was admitted on 7th July, 1939, to the hospital attached to the Calcutta School of Tropical Medicine. He gave no history of kala-azar, but a vague history of some undiagnosed fever in childhood. Nodules began to appear on different parts of his body about five years ago.

*Present condition.*—He had a distinct reddish flush of his cheeks and chin, and at times, after exposure to the sun, his whole body showed this flush. He had typical post-kala-azar dermal-leishmaniasis nodules and depigmented areas all over his face and body. Those on his face, and especially those at the skin-mucous-membrane junctions, were smooth reddish bullous nodules, soft and rubbery to feel, but formed of solid though loose-textured tissue. The eyelids were involved in these swellings, his eyes were watery, and he kept them half closed (*vide* plate XXXI, figures 2 and 3); also, he had photophobia.

A nodule was removed from his chin; a smear made from the cut surface of this nodule showed abundant leishmania.

Both corneae showed numerous opacities; the right had a pannus all round the periphery, and the left was almost completely opaque from the nodular growth covering half of it. There was marked vascularization. The vision in the left eye was almost nil but improved to 'counting fingers at one metre'; in the right eye vision was only sufficient for him to walk alone with difficulty, but it improved to 3/60.

He was sent to the eye hospital on 20th September, 1939: at this time the eye condition was as follows:—

Both upper eyelids are somewhat thickened, but the lower eyelids are normal. The palpebral conjunctivae are not involved, and the bulbar conjunctivae are only affected in the vicinity of the limbi. The corneae show a diffuse haziness, multiple opacities, marked pannus extending all round the periphery, deep vascularization and infiltration into the substantia propria.

The most striking point is the presence of nodules in the vicinity of the limbi and these have spread superficially to form a pannus and deeply to form an interstitial keratitis. Vascularization is very marked, and as the disease has progressed it has gradually extended around the corneae. The sclera approximating the cornea is involved in part and the disease has probably originated from here as an episcleritis.

The ciliary body and iris are very slightly involved; there are some posterior synchia but no evidence of active inflammation. There is no anaesthesia and very little pain. The left eye is more affected than the right eye.

The clinical picture might on first examination be confused with trachoma or leprosy, if it were not for the presence of typical post-kala-azar dermal-leishmaniasis nodules on the patient's face and body; but on closer observation the appearance is very different. Blepharospasm, photophobia and epiphora although present were not marked signs.

*Treatment.*—He was given potassium iodide, gr. xv, *t.d.s.*; the dose was gradually increased until by the 18th day he was taking gr. xxx, *t.d.s.*, which dose he took for 14 days. On the 24th day of the iodide course he was given neostibosan 0.3 g. every other day up to 12 doses. After a further month's interval he was given urea stibamine, doses up to 0.2 g., on alternate days for 12 doses.

During the interval, one or two isolated nodules were injected with 2 per cent berberine sulphate. The injected nodules shrunk slowly but did not disappear.

*Progress.*—After a month of potassium iodide, the patient felt very ill and his face was swollen. He improved immediately the iodide was discontinued. It was noticed that the lesions were slightly reduced.

After the second course of antimony the skin condition was distinctly better and he left hospital.

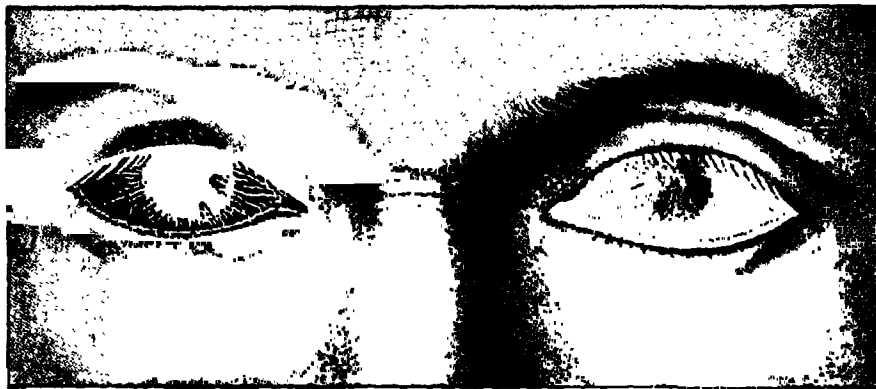
*Re-admission.*—He was re-admitted on 6th July, 1940; the nodules had by then nearly disappeared (figure 4), but his sight was still poor and he was anxious to have further treatment with the idea of improving this.

Figure 1, plate XXX, shows the condition of the eyes at this time.

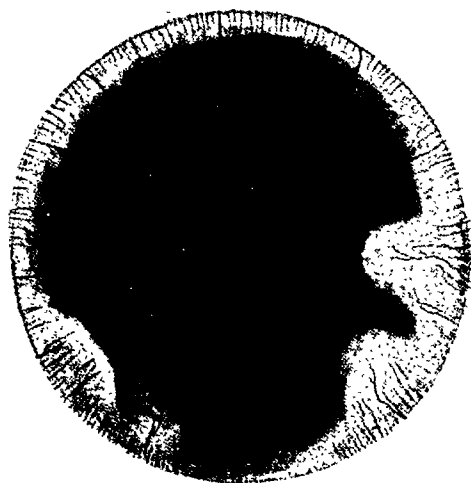
He was again sent to the eye hospital with a request that the growth over his cornea should be removed for examination for the presence of leishmania.

The large diffuse nodule on the left eye was incised at the limbus and a small piece of the inflammatory tissue removed. Smears from this tissue showed the presence of leishmania.

PLATE XXX



Keratitis due to dermal leishmaniasis.



R. E.



L. E.

Fig. 1.





Fig. 2.—Showing condition on first admission.



Fig. 4.—Showing condition at time of re-admission.

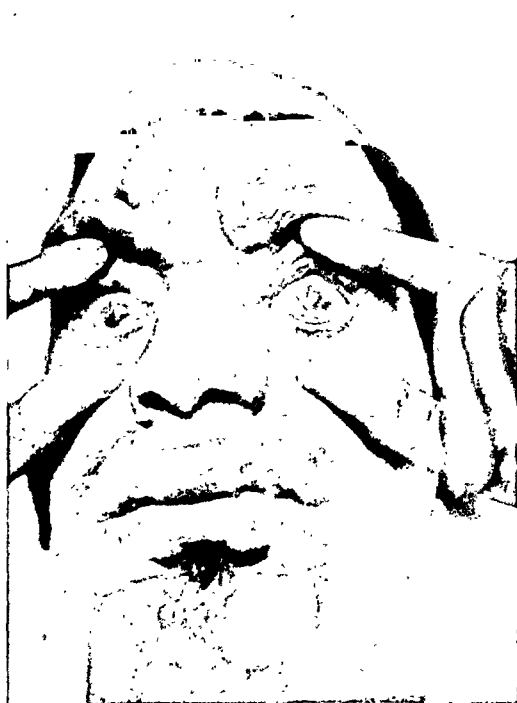


Fig. 3.—Showing condition on first admission.



Fig. 5.—Showing condition on final discharge.

*Treatment.*—He was given 20 injections of aminostiburea, 0.2 g. each, on alternate days from 7th August to 14th September, when he was discharged.

At the time of discharge his sight was much further improved (figure 5).

*Sight.*—On the 20th September, 1939, the vision was:—

R. E. 3/60: L. E. 1/60

After treatment on the 20th July, 1940, the vision was:—

R. E. 6/36: L. E. 2/60

*Comment.*—This was a fairly typical case of post-kala-azar dermal leishmaniasis; in Bengal, it has been calculated (Napier, 1931) that about 5 per cent of persons suffering from kala-azar eventually develop the local lesions. If the history is correct the patient recovered from the visceral infection without any specific treatment; this is not unusual, for about 25 per cent of patients with this condition give a similar history. The bullous lesions are not seen as frequently as the ordinary nodular lesions, which this patient also showed, but are not rare, and the photo-sensitive flush is quite common.

The only uncommon feature in this case was the condition of the eyes.

The reference in the literature to leishmanial infections of the eye appear to be rare. On the subject of leishmanial keratitis, Duke-Elder (1938) in his well-known textbook writes:—

‘Corneal involvement by *Leishmania* is very rare. The mode of infection is not proven, but it is probably by direct inoculation from the fingers: it does not occur in persons who have had the disease, and the corneal infection confers subsequent general immunity. The clinical picture produced is characteristic (Chams, 1929). Starting with irritative symptoms of pain, photophobia and lacrimation, a superficial erosion or a phlyctenule-like efflorescence appears on the cornea, which is quickly associated with a deep infiltration. The infiltration pervades the entire cornea, in the centre of which an abscess forms, which in the 3rd or 4th week discharges itself either exteriorly or into the anterior chamber, the result being blindness, or loss of the eye. Treatment should be by the application of mild antiseptics, as methylene blue with atropine, combined with general arsenical treatment: cauterization involves the formation of unusually dense scars. If it is undertaken energetically before the end of the 2nd week the prognosis as regards the eye is good, while fair vision may be retained; if its inception is delayed until the 4th week more than half of the cases end in perforation.’

We have not consulted the Chams reference, but presumably he refers to *Leishmania tropica* infection, secondary to oriental sore. In this condition auto-inoculation is a recognized mode of spread of the infection. Oriental sore does not occur in Bengal and this patient never left the province. In this case the skin condition is due to an hæmatogenous infection of *Leishmania donovani*. In this form of dermal leishmaniasis the assumption is that the wide distribution of the leishmania takes place at the time of the visceral infection when the parasites are in the peripheral blood. Whilst the dermal lesions may not all reach the clinical threshold at the same moment, for some develop more slowly than others, they do not appear in successive crops, there is no evidence that extension

from the earlier lesions ever takes place, and the question of auto-inoculation need not be considered as the lesions are non-ulcerative. As the cornea is a non-vascular tissue, the leishmania cannot have been there from the time of the visceral infection and in this case extension from the sclera must have taken place, as occurs in tuberculous episcleritis.

The response of the dermal lesions to treatment was characteristically slow, but, as is usually the case, the condition was eventually cured, and in this instance the eye lesions also showed considerable improvement and possibly after a lapse of time these will have improved further, but we have now lost track of this patient.

Had this condition been left untreated, we do not anticipate that it would have followed the course described by Duke-Elder, for neither ulceration nor abscess formation occur in post-kala-azar dermal leishmaniasis (*L. donovani* infection), whereas the former is the rule in oriental sore (*L. tropica* infection); it is however probable that the infiltration and vascularization of the cornea would have proceeded further and eventually produced complete blindness.

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#### AN INTERESTING CASE OF MALARIA

By S. N. MITRA

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IN this district during the last 12 years' practice, I cannot recall more than two intractable cases of malaria that failed to respond to quinine, and so the following case can be described as rare even in a hyperendemic area of malaria.

A male, aged about 46 years, working as a factory Babu for the last 6 years. During this period he had suffered from malarial fever twice. During the monsoon he is very particular to take prophylactic quinine (gr. 5 in a capsule or as a pill) daily.

*First attack.*—On the 18th July, 1938, at about 11 a.m., I was called to attend him for fever, and I found him in the following condition:—

Temperature 99.8°F., rigor and headache present. Bowels moved once and not constipated. Spleen not palpable. Other signs and symptoms—nothing noteworthy. A blood film both thick and thin was taken, and showed no parasite (taking prophylactic quinine daily).

*Treatment.*—One calomel powder of gr. 3 to be followed by a dose of Epsom salts 2 hours later.

I instructed the patient to take the following mixtures:—

Mist. alkaline .. .. . 1 oz. t.d.s.  
Mist. quinine bihydrochloride (gr. 7 to 1 oz.) 1 oz.

t.d.s. 1 hour after alkaline mixture.

At about 7 p.m. the temperature came down to normal with much sweating, and headache disappeared. Bowels moved several times.

*Second day.*—At 8 a.m. temperature 97.6°F., at 12 a.m. rose to 101°F. with shivering and headache, but

A serious danger is that the repeated failure to obtain permission for an autopsy will discourage efforts to get this permission on subsequent occasions; this is such a real danger that a very great effort should be made by the senior members of the staff to break the run of failures, and once this run is broken matters will be easier. If a 'tradition' can be established, it will usually be possible to get an autopsy whenever it is required. To show that this last remark is not just wishful thinking, we will give a concrete example.

Twenty odd years ago a tea-garden medical officer, realizing the importance of post-mortem examinations, attempted to obtain permission for an autopsy whenever a patient died in his hospital. He eventually obtained the permission from a coolie to do a post-mortem examination on her dead partner; there was a riot in the garden and the other relatives threatened to burn down the house and hospital. For a short time the hospital was boycotted, but its value was so obvious that it soon regained its popularity. A few weeks later a coolie died suddenly in rather doubtful circumstances; the doctor refused to sign the death certificate without a post-mortem examination, which was opposed, so he informed the police and naturally suspicion fell on all those who had opposed the post-mortem examination. The next time the doctor asked to be allowed to do a post-mortem examination on legal grounds, it was allowed and there was no riot. The tea company made certain allowances for funeral expenses; if a post-mortem examination was refused when the doctor asked for it, these allowances were not paid. So, by a process of legal and economic pressure the prejudice against autopsies was gradually

broken down. Care was taken to do the examinations with the least possible disfigurement to the body, and in time not only was there little opposition but there was often a demand for a post-mortem examination. This practice has passed into the hands of a second and now a third medical officer, both keen and intelligent men who have maintained this tradition, and to-day one can obtain a post-mortem examination on anyone who dies on these tea estates without any trouble.

In a town conditions are of course different, and the population from which a hospital draws its patients is so large that it would take much longer to establish such a tradition.

We agree with Dr. Tribedi that it is not so much legislation that is required as official support. It should, for example, surely be possible to limit the legal rights of the funeral societies. We know nothing of the legal aspect of the case but the societies must have been given some legal status, otherwise the hospital authorities would have no obligation to hand over the bodies to them. It should be possible to give the hospital authorities the right to do a post-mortem examination before handing over the body. In many hospitals in England, the patient's relatives are asked to sign a declaration that they will not oppose a post-mortem examination, before the patient is admitted to hospital; the question of introducing this practice in the large teaching hospital in India might be considered.

## Special Article

### AUTOPSY STUDIES IN INDIA

By B. P. TRIBEDI, M.B. (Cal.), D.B. (Lond.)

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THE president of the Indian Medical Association while discussing the dearth of medical researches in India (Roy, 1941) observed that the condition is such that 'any country ought to be ashamed and particularly India, whose genius and scientific talents are by no means wanting'. At the same conference, the vice-chancellor of the Andhra University said that in the progress of scientific medicine the contributions from Indians were not much in evidence (Reddy, 1941).

If this is so, we should take stock of the existing circumstances and try to realize the gravity of the situation. There is a general opinion amongst the medical public that India should take up post-graduate teaching more seriously and should provide greater facilities for research in the field of medical science. Several of our universities are moving in this matter. Whether we consider medical research, post-graduate or under-graduate teaching, or any scheme for the improvement of medical

study, the question of post-mortem material comes in the forefront.

Bluestone (1922) made the following significant statement, 'Broadly speaking, no hospital is larger than its pathological laboratory. The progressiveness of a hospital is in direct ratio to the laboratory spirit which it maintains'. In any pathological laboratory, the post-mortem examinations supply the bulk of the material for higher study. Hektoen (1926) pointed out that the hospital which neglects the autopsy thereby limits its usefulness; further, he found no need to waste words in an argument in favour of a proposition that necropsy percentage is an index of hospital efficiency, because it was so self-evident.

So far as India is concerned the position of necropsy studies is far from satisfactory. In order to get the exact state of affairs at the present time, we have collected figures from different medical educational institutions in India. We issued a request to the heads of the various teaching institutions in Bombay, Madras, Bengal, Bihar, U. P., Punjab, Delhi, and Assam to let us have the total number of deaths in the hospitals and the total number of post mortems done during 1930-39, a period of 10 years. Most of them were good enough to comply with our requests. The information obtained is given in the following tables:—

TABLE I

Showing the combined all-India figures of total deaths and number of post-mortem examinations done in various teaching hospitals during the period 1930-39

Names of institutions	1930		1931		1932		1933		1934		1935		1936		1937		1938		1939	
	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done	Total number of deaths	Number of autopsies done
1 Government General Hospital, Madras	1,010	77	947	127	984	79	1,084	81	1,164	76	1,264	90	1,236	63	1,402	68	1,472	65	1,611	59
2 Berry White Medical School, Dibrugarh	157	4	160	11	155	7	142	8	161	8	168	11	193	7	217	8	240	8	199	7
3 King George's Medical College, Lucknow	329	49	420	26	418	38	400	41	542	37	571	20	527	43	526	31	547	29	577	24
4 Prince of Wales Medical College, Patna	436	28	492	31	534	27	513	19	837	28	756	17	761	21	1,404	28	1,002	29	1,095	31
5 Lady Hardinge Medical College, New Delhi	136	..	147	..	134	..	199	..	170	..	154	1	215	1	200	1	180	2	231	2
6 Medical College Hospitals, Calcutta	1,149	124	1,351	95	1,546	70	1,311	54	1,358	75	1,334	79	1,522	100	1,418	138	1,605	139	1,506	118
7 Campbell Medical School and Hospital, Calcutta	2,412	119	2,243	98	1,843	91	2,672	76	2,590	103	2,710	83	3,046	89	2,221	141	2,801	85	3,182	86
8 Ronaldshay Medical School, Burdwan	169	11	288	7	241	15	283	11	317	9	146	15	216	13	249	12	300	14	289	11
9 Lytton Medical School, Mymensingh	152	4	150	9	163	15	161	19	183	14	156	11	172	9	213	10	226	13	232	4
10 Jackson Medical School, Jalpaiguri	118	..	138	..	129	4	156	5	164	8	161	5	218	5	231	9	252	7	261	3
Total	6,068	416	6,336	404	6,147	346	6,921	314	7,486	358	7,420	332	8,106	351	8,081	446	8,625	391	9,183	345
PERCENTAGE	..	6.8	..	6.3	..	5.6	..	4.5	..	4.7	..	4.4	..	4.3	..	5.5	..	4.5	..	3.7

TABLE II

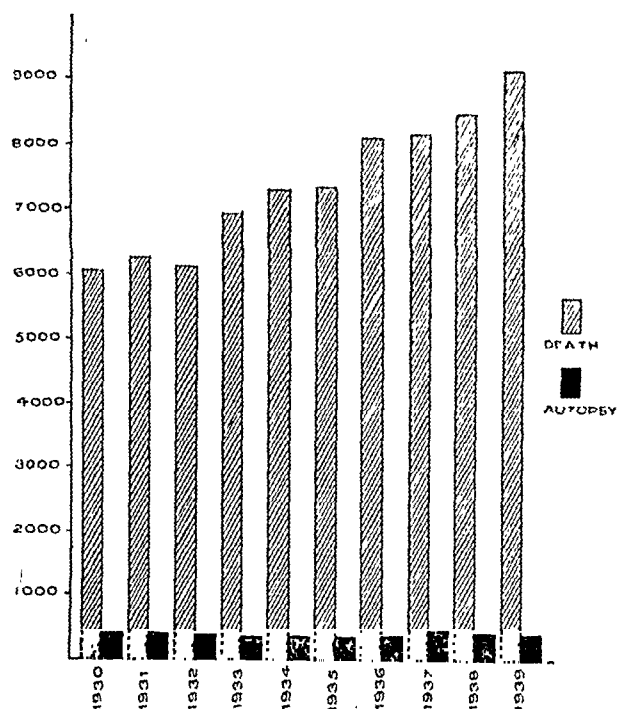
Showing the total number of deaths and post-mortem examinations between the years 1930-39 in individual institutions

Serial number	Names of institutions	Total number of deaths during 1930-39	Total number of autopsies during the same period	Percentage
1	Government General Hospital, Madras ..	12,174	785	6.4
2	Berry White Medical School, Dibrugarh ..	1,792	79	4.4
3	King George's Medical College, Lucknow ..	4,857	338	6.9
4	Prince of Wales Medical College, Patna ..	7,830	259	3.3
5	Lady Hardinge Medical College, New Delhi ..	1,769	7	0.3
6	Medical College Hospitals, Calcutta ..	14,100	992	7.03
7	Campbell Medical School and Hospital, Calcutta ..	25,720	971	3.7
8	Ronaldshay Medical School, Burdwan, Bengal ..	2,498	118	4.7
9	Lytton Medical School, Mymensingh ..	1,808	108	5.9
10	Jackson Medical School, Jalpaiguri ..	1,828	46	2.5
PERCENTAGE OF AUTOPSY ON THE TOTAL NUMBER OF DEATHS DURING 1930-39 IN ALL THE INSTITUTIONS.		..	..	4.9

Figures from two institutions could not be included here, as we had no permission to publish them. The figures reported above cannot be taken as an absolutely correct index of the autopsy percentage, because these do not include all institutions in India, but it seems quite reasonable to accept the figures given above as a rough indication of the state of affairs. In table II, it will be seen that figures from at least one institution of most of the provinces were included which will thus enable us to form an idea of the condition of autopsies in the country as a whole. From the data given above we are in a position to say that during 1930-39 a period of 10 years post mortems were held in less than 5 per cent cases of total deaths in the

hospitals. Is this number of post mortems sufficient for the teaching and progress of scientific medicine in India?

Christian (1926) while discussing the points for selecting a hospital for an internship described the various groupings of hospitals as done by the American Medical Association. An institution may be class A, so far as the efficient treatment and comfort of the patients are concerned, but, so far as the facilities of teaching, the same institution may be of class C, i.e., though the institution has the best arrangements for treatment, as a teaching institution, it may be far from satisfactory. Christian further discussed what should be the criterion of a class A teaching institution. He pointed out that 'for a definite educational value, there must be instruction and guidance. The men on the staff are more important than the equipment of the hospital, and the number and type of the patients. They must be willing to instruct the interns; they must be willing to spend time in the hospital engaged with the interns in the study of patients; they must be well trained themselves and they must know how to teach'. Nothing could be more true and these points should be impressed upon those who guide the medical institutions in our country. He further observed 'looking about for any other criterion it has seemed to me that the number of necropsies obtained in patients dying in the hospital is perhaps the best single index of professional efficiency of the hospital, of the amount of work devoted to the study of patients by members of the staff, of the eagerness of the staff to learn, and its teaching abilities. In my opinion, who has studied his patients conscientiously and has watched the progress of the disease from day to day, who has discussed the disease and its manifestations in the patients with the interns, who is sincerely desirous of learning more of the medicine, is the physician who makes every effort to secure permission for necropsy in all



Graphical representation of total number of deaths and autopsies in India during the period 1930-39.

fatal cases and is keenly interested in what is found. When such men make up the staff of any hospital, necropsy permits are sought in all fatal cases and obtained in good number; and hence the percentage of necropsies obtained in any hospital forms a very good index of the professional efficiency of the institutions and the desirability of that hospital as a place of an internship'.

Christian is further of opinion that any hospital in which the necropsies are 25 per cent or more of the number of deaths might be regarded as a desirable place for an internship. If we judge the Indian hospitals according to Christian's standard where do we stand?

Now let us examine how autopsies can be obtained, viz, by (a) state legislation, (b) voluntary permit, (c) post-mortem examination done on unclaimed bodies. In India, so far as voluntary permits are concerned, it is almost negligible and there are no state laws to encourage diagnostic post mortems. So, at the present moment, we have to depend mainly upon the unclaimed bodies. The 5 per cent deaths that we are getting for necropsy now is due to the above fact. Unclaimed bodies, i.e., patients picked up from the streets, street beggars and extremely poor people who could not afford to meet the funeral expenses, are being disposed of by the hospitals as they like. So it appears that at present we have to depend upon deaths of a class of people whose standard of living is lowest. It is expected that with the general rise in the standard of living in future, we may not have such unclaimed bodies as we are getting now. In that case even this extremely low figure of 5 per cent is bound to come down. To make things worse, at the present moment the progress of scientific medicine is being attacked from another direction. There are religious and communal bodies whose functions include looking after the unclaimed dead of their community. In Bengal, Christians and Muslims have such organizations which generally take away all the unclaimed bodies. So the bulk of the dead bodies required by the institutions is supplied from the unclaimed Hindu bodies. Recently, the Hindus have also started an organization to take away all the unclaimed dead bodies. The result is that the teaching institutions are faced with a very serious situation. In the Campbell Medical School Hospital, Calcutta, with an average of about 2,500 annual death rate, last year there were only two post mortems (personal communication). If this state of affair continues what will happen to medical education?

What is the argument of these communal organizations in taking away unclaimed bodies? Obviously, it is the desecration and mutilation of the dead. I am not concerned with the anatomical dissection, but in cases of diagnostic necropsies the question of mutilation should not come in. The communal organizations may be

assured that the post mortems are conducted by specialists who have had special training and experience in the subject, and that they are conducted with proper respect for the dead. It can be compared with a surgical operation. After the autopsy, the dead bodies are finally neatly made up; this practically rules out the question of disfiguration.

When we consider that necropsies are done for the sake of enhancing the knowledge of a science which aims at the good of mankind, no religion can reasonably stand against such a step. Does not religion stand for the good of humanity? Basu (1934) suggests state legislation for compulsory post mortem. This is rather too drastic a step and might affect very adversely the hospital attendance by the public. Even in the most progressive countries this sort of legislation could not be imposed, so in a backward country like ours this is hardly possible. Moreover, those who will formulate such legislation will have to be convinced first, otherwise what chance is there of such a measure being passed through the legislatures? So the members of the legislature will have to be educated first before we can think of any legislative measure. With this idea we issued an appeal (Tribedi, 1940), which had very strong support from many scientific men of our country (personal communication and Gharpure, 1941).

The Editor of the *Calcutta Medical Journal* (1940) while very strongly supporting our contentions observed 'the necessity of affording facilities for the growth and development of medical science rests on those who are at the helm of administration and their actions should be actuated by no other consideration than advancement of medical education and improvement of the health of the country. It is not necessary to enact any legislation to this end. So long as the profession is assured of their good will, moral support, and active co-operation, they will be able to make better headway. To this end, with proper training, there should not be much objection from the public. When the people of the country could be trained to acquiesce themselves to medico-legal post mortems, there is no reason why they will not submit to medical post mortems, if the subject is well explained to them'.

Education of the public is essential, but who is going to educate them? Certainly the medical men of the country are the people to take up this work. The heads of the various departments must make it a point to see that the autopsy figures are increased. Christian (1926), as reported above, has put it in the best way. Physicians and surgeons who are responsible for the running of their own unit must see that all those who work under them, the resident medical officers, the interns, and the nurses, be all inspired and taught about the technique of getting voluntary permits. The initial movement must start at the hospitals.

It is worth narrating a very recent incident in our hospital which should be an eye opener to everybody.

On 18th March, 1941, a girl of nineteen was admitted for progressive enlargement of the liver and fever with jaundice. The enlarged liver gradually filled up the whole of the abdomen and after a month in the hospital the girl died. The chief of the unit where the girl was admitted was very anxious to learn something about the case. All the time during the child's illness the staff used to say to the parents that they were doing their best but they were in the dark. The parents were satisfied that the hospital staff were doing their best. They were heard to remark on many occasions while they came to visit the child—'Oh, they are doing their best because whenever we happen to be near the bed we find how anxious the doctors are about our child'. When the child died, the chief spoke to them about making a small incision in order to learn something about the case as he was in the dark. The mother and father replied 'Doctor, when you have done so much for our poor child, we are willing to help you in increasing your knowledge, so that you might gain something which may go to cure some other child', but they gave two conditions, viz, the body must not be removed to the mortuary and the operation must be done by the chief himself. So the chief got one of the most instructive cases.

This incident is very significant. The one fact that made the parents agree was that they were impressed that the hospital did so much for the child. When the request for an incision came, it came from a group of friends. This fact is of the utmost importance for getting a voluntary permit. Everything depends upon the sympathy, tact and friendliness that are exhibited by the hospital staff to the sick and their relatives. If the relatives feel that the patient while alive was not treated properly and not well looked after, and that the relatives were not treated with sympathy, it will be useless to talk about a post mortem. Outside the hospital, the education of the public will have to be done by the family doctor. We gave the details of the scheme in the previous publication (Tribedi, 1940). These doctors in their student days, if they had proper inspiration from their teachers, are bound to get autopsy-minded throughout their careers. So it is evident that in obtaining voluntary permits, success depends upon the type of teachers that an institution has got. Need they be reminded 'the greatest diagnosticians of the present and the past generations have been those who spent years studying their fatalities at the autopsy table'?

The state also has a tremendous amount of responsibility in this matter, specially in a country like ours where the general standard of education is so low. As has been pointed out before, strict legislation is not always very helpful, but there should be sufficient gesture from the state that they encourage necropsies. In medico-legal cases, the state compels an autopsy, because it is the duty of the state to detect and punish the criminals. If we admit that scientific progress is similarly a state responsibility, it is expected that the state also will help us in this matter. For instance, in our country the state should not allow the unclaimed

dead to be taken away from their hospitals by communal organizations, if an autopsy be desired by those who treated that patient. If the communal organizations must take responsibility of the disposal of those unclaimed dead ones, they can be easily asked to take over after the autopsy has been performed and the body is satisfactorily reconstructed.

This is not much that we ask. For the progress of medical science, the government of the country must co-operate with the scientists. The medical science is not solely a test-tube phenomenon. Our programme of work is different from the physicists and chemists in this respect. We must get materials in the living and in the dead to work upon. We medical men are entrusted with the responsibilities of keeping the nation healthy and fit. If this is so, we have every right to expect help from those who can render it for the fulfilment of our mission. We hope our appeal will not go in vain.

Our grateful thanks are due to the principals of the medical colleges and schools who have very kindly responded to our request in furnishing the figures reported in this article.

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## Medical News

### THE SIXTH MAHARASHTRA AND KARNATAK PROVINCIAL MEDICAL CONFERENCE, POONA

THE Sixth Maharashtra and Karnatak Provincial Medical Conference will be held at Poona under the auspices of the Poona Branch of the Indian Medical Association on the 13th, 14th and 15th October, this year. The main subject for discussion is 'Blood-pressure in health and disease'. Papers on other medical subjects will also be read and discussed. An exhibition of medical products, surgical appliances and interesting specimens is being arranged. All medical practitioners in the province are cordially invited to attend the conference.

### DRUG MANUFACTURE AND RESEARCH WORKERS

IN order to establish closer co-operation and co-ordination between the manufacturers and research institutions, the Indian Chemical Manufacturers' Association has approached important Universities in India carrying on research with a request to include representatives of manufacturers of chemicals and drugs on the Advisory Boards of the Universities. It is pointed out that association of manufacturers with Advisory Boards would enable them to give their suggestions about researches that would be useful to







TABLE II

*Drugs which are essential for certain purposes but not for others, and in the use of which strict economy should be observed*

Acetoneum *	
Acidum Aceticum	
Acidum Benzoi-cum.	
Acidum Boricum	Boric acid in boric lint is wasted. Reserve for cataplasma kaolini and eye lotions. In dermatological practice saline compresses may be used instead of boric fomentations, and for dusting powder boric acid may be replaced by zinc oxide, magnesium trisilicate or kaolin.
Acidum Citricum	Manufacture under Government control.
Acidum Lacticum	
Acidum Nitricum	
Acidum Oleicum	
Acidum Tartari-cum and its salts.	Raw material is imported. Production within the Empire should be encouraged.
Adeps Benzoin-atum *.	
Agar	Substitute:—Ispaghula. Agar should be reserved for bacteriological media. Production within the Empire should be encouraged.
Alcohol	Many tinctures can be replaced by concentrated preparations. Economy is essential.
Amylum *	In dermatological practice substitute saline compresses for starch poultices, and for powders see remarks under boric acid.
Aurantii Cortex †	Countries of origin:—Spain, Sicily, Malta. Limited supplies are available from the Empire at present.
Benzaminæ Hydrochloridum.	
Benzaminæ Lactas	
Bismuth Salts	Reserve for the treatment of syphilis and tropical diseases. Substitutes (for gastro-intestinal conditions):—Aluminium hydroxide, chalk, kaolin, magnesium trisilicate.
Bismuth Salicylas	Reserve for the treatment of syphilis and tropical diseases. Substitutes (for gastro-intestinal conditions):—Activated charcoal, kaolin.
Borax	In dermatological practice reserve for unguentum aquosum. Glycerine of borax and honey of borax may be replaced by aqueous solutions of aniline dyes in the treatment of thrush.
Bromides	Strict economy is necessary.
Caffeina	Omit from compound tablets such as compound aspirin tablets.
Caffeina et Sodii Benzoas.	Amphetamine (benzedrine), leptazol (cardiazol) and nikethamide (coramine) are partial substitutes.
Capsicum	Countries of origin:—Nigeria, Sierra Leone, E. India. Restrict use of capsicum to manufacture of capsicum wool. Substitute:—Sinapis. Colonial varieties of capsicum may be obtainable.
Carbromalum	

\* With restrictions as to the method of manufacture or under Government control.

† Production in the United Kingdom or Empire should be encouraged.

TABLE II—contd.

Caryophyllum	Countries of origin:—E. India, Zanzibar, Pemba, Madagascar. Reserve for distillation of the oil.
Cascara Sagrada †	Countries of origin:—Canada, U. S. A.
Chrysarobinum †	Substitute:—Dithranol.
Cinchona †	
Corpus Luteum and its preparations.	
Cyclopropanum	
Desoxycorticosterone and its esters.	Extract of suprarenal cortex is in freer supply.
Dextrosium *	Reserve for injection.
Dextrosium Monohydratum *	Strict economy is essential.
Extractum Hepatis Liquidum (and preparations of the active principles of liver).	Importation of liver is under Government control. Injection therapy is more economical and effective than administration by mouth. Desiccated stomach may be substituted for liver for oral administration.
Extractum Malti *	
Extractum Parathyroidei (and parathyroid preparations for parenteral injection).	
Ferri et Ammonii Citras.	Not the most economical form of iron: ferrous sulphate is cheaper.
Ferri Lactas	
Ferri Subchloridum Citratum.	Not the most economical form of iron: ferrous sulphate is cheaper.
Filix Mas	Reserve for use when other anthelmintics are contra-indicated. Production in the United Kingdom should be encouraged.
Galla	
Glucosum *	Strict economy is essential.
Glycerinum	Substitutes are under investigation.
Glycyrrhiza †	Countries of origin:—Spain, Sicily, Italy, Iraq, U. S. S. R.
Hydrargyrum	
Hydrargyrum Ammoniatum.	
Hydrargyri Iodidum Rubrum.	
Hydrargyri Oxidum Flavum.	
Hydrargyri Oxycyanidum.	
Hydrargyri Perchloridum.	Substitute:—A phenolic antiseptic of the chlorinated phenol type.
Hydrargyri Subchloridum.	
Ichthammol	
Injectio Hepatis Iodum †	Adequate supplies are available, but owing to shortage of alcohol, the use of alcoholic solutions of iodine must be greatly restricted. Substitutes:—Aqueous solutions of iodine, acriflavine, brilliant green, crystal violet, proflavine, and trinitrophenol.
Ipecacuanha †	Galenical preparations of ipecacuanha such as expectorants and emetics are not essential and the crude drug should preferably be reserved for the manufacture of emetine.
Jaborandi †	Reserve for the manufacture of pilocarpine.
Jalapapa	} Reserve for veterinary use. Countries of origin:—Mexico, India. Substitute:—Colocynth.
Jalapapa Resina	

TABLE II—*concl'd.*

Lactosum	
Lævulosum	
Liquor Vitamini A Concentratus.	
Liquor Vitamini D Concentratus.	
Liquor Vitaminorum A et D Concentratus.	
Magnesii Chloridum.	Reserve for veterinary use.
Mel *	
Oestradiol, Oestriol, Oestrone and their esters.	
Oleum Arachis	
Oleum Chenopodii †.	In Great Britain reserve for veterinary use. Substitutes:—Carbon tetrachloride, thymol.
Oleum Gossypii Seminis.	
Oleum Hippoglossi	
Oleum Lini *	Reserve for internal use in veterinary practice.
Oleum Morrhuæ *	Substitute:—Oleum vitaminatum and veterinary vitaminized oils, as applicable to relieve scarcity.
Oleum Olivæ *	Arachis and other suitable vegetable oils are recognized as substitutes in official preparations.
Oleum Rapæ	Reserve for external use in veterinary practice.
Oleum Sesami	See under Oleum Amygdalæ.
Paraffinum Liquidum *.	Its use should be discouraged.
Paraffinum Molle *	
Parathyroideum	
Pilocarpina and its salts.	Substitute:—Physostigmine and its salts for most purposes.
Pituitarium	Including anterior lobe extracts.
Podophylli Resina	Restrict to Indian podophyllum.
Potassii Tartras Acidus.	See under Acidum Tartaricum.
Proactin	
Quillaia	Countries of origin:—Chile, Peru, India.
Santoninum †	Countries of origin:—U. S. S. R., Kashmir. Importation difficult. Substitutes:—Hexylresorcinol, phenothiazine.
Sodii Benzoas	
Sodii Bromidum	
Sodii Citras	See under Acidum Citricum.
Sodii Lactas	Reserve for use as a glycerine substitute.
Sodii et Potassii Tartras.	See under Acidum Tartaricum.
Spiritus Aetheris Nitrosi.	Substitute:—Concentrated solution of ethyl nitrite.
Spiritus Methy-latus Industrialis *	
Syrax †	Country of origin:—Asiatic Turkey. Wanted for compound tincture of benzoin.
Sucrosum *	
Syrups	The use of all syrups should be discouraged.
Syrups Ferri Phosphatis.	Reserve for children.
Tinctures	Many tinctures can be replaced by concentrated preparations. Economy is essential.
Urginea	Importation difficult in war time.
Valeriana †	
Zinci Chloridum	
Zinci Oleostearas	

TABLE III

*Drugs which are not essential and do not justify importation or manufacture for home use in war time*

Drug	Substitute	Countries of origin
Acetanilidum	Acetylsalicylic acid or phenacetin.	..
Acetylcholine	..	..
Acidum Glycero-phosphoricum and its salts.	None necessary	..
Acidum Hydrobromicum.	..	..
Aconitum	Benzocaine for local application.	Germany, Switzerland, France.
Aethylenum	..	..
Alcohol Isopropylicum.	..	..
Amidopyrina	Acetylsalicylic acid, phenacetin.	..
Balsamum Tolu-tanum †.	..	Columbia, South America.
Betainæ Hydrochloridum.	..	..
Bromoformum	..	..
Buchu	Hexamine, mandelic acid, scoparium, sulphanilamide.	S. Africa.
Calumba †	Quassia	E. Africa (Mozambique).
Cannabis Indica	..	India, S. Africa, Zanzibar.
Cantharis	Sinapis	U. S. S. R., Spain, Hungary, China.
Cantharidinum		
Carum †	Anethum (dill).	Holland, Germany.
Cassia	..	China.
Coccus	Solution of Bordeaux B. Other good colours are available.	Canary Islands.
Copaiba	Hexamine, mandelic acid, scoparium, sulphanilamide.	Northern South America.
Coriandrum	Cardamomum	Morocco, U. S. S. R., India, Central Europe.
Cubeba	Hexamine, mandelic acid, scoparium, sulphanilamide.	Malayan Archipelago.
Cusso	Carbon tetrachloride, male fern.	N. E. Africa.
Erythritylis Tetrinitras Dilutus.	..	..
Ferri Arsenas	Ferrous sulphate with arsenic.	..
Ferri et Manganii Citras.	Ferrous sulphate	..
Ferri et Quininae Citras.	Ferrous sulphate	..
Ferri et Potassii Tartras.	Ferrous sulphate	..
Ferri et Strychninae Citras.	Ferrous sulphate with strychnine.	..
Ferri Glycero-phosphis.	Ferrous sulphate	..

\* With restrictions as to the method of manufacture or under Government control.

† Production in the United Kingdom or Empire should be encouraged.

TABLE III—*contd.*

Drug	Substitute	Countries of origin
Ferri Hypophosphis.	Ferrous sulphate	..
Ficus	Therapeutic value doubtful.	..
Fœniculum †	..	..
Gelsemium	Synthetic analgesics.	U. S. A.
Gentiana †	Quassia	France, Germany, Spain. Almost unobtainable.
Hamamelis †	Tannic acid	U. S. A.
Injectio Ferri	Ferrous sulphate by mouth.	..
Krameria †	Tannic acid	Peru.
Linum	Cataplasma kaolini for poultices.	..
Lobelia †	Stramonium	Eastern U. S. A.
Lobelina	Nikethamide, leptazol.	..
Magnesii Sulphas	Sodium sulphate, of which very large supplies are available.	..
Methylsulphonal	..	..
Oleum Abietis	Any oil of pine	North-east U. S. S. R.
Oleum Amygdalæ †	All vegetables, oils and fats are under Government control. Arachis and other vegetable oils may be used if available.	..
Oleum Camphoræ Rectificatum.	Oleum terebinthinæ. See Camphora.	..
Oleum Cardamomi	..	..
Oleum Cari	See Carum	..
Oleum Crotonis	Unnecessary oleum gaultheriæ. Methyl salicylate.	..
Oleum Santali	Hexamine, mandelic acid, scoparium, sulphanilamide.	India.

TABLE III—*concl.*

Drug	Substitute	Countries of origin
Pelletierinæ Tan-nas.	Carbon tetrachloride, male fern.	Mediterranean countries.
Phenazonum	Acetylsalicylic acid, phenacetin.	..
Potassii Bicarbonas.	Sodium bicarbonate.	..
Potassii Bromidum.	Sodium bromide	..
Potassii Chloras	Not essential	..
Potassii Citras	Sodium citrate	..
Potassii Hydroxidum.	Sodium hydroxide	..
Potassii Iodidum	Sodium iodide	..
Potassii Nitras	Not essential	..
Potassii Permanganas.	Solutions of other permanganates.	..
Psyllium *	Ispaghula	Mediterranean countries.
Salicinum	Sodium salicylate	..
Salol	..	..
Scammonium	Indian podophyllum.	..
Scilla †	Urginea (Indian squill) and other expectorants.	Sicily.
Senega	Ammonium carbonate, ammonium bicarbonate, ammonium chloride.	Canada, U. S. A.
Sodii Tauroglyco-cholas.	Extract of ox bile	..
Sparteina	..	..
Strophanthus	Digitalis	Mozambique, Nyasaland.
Sulphonal	..	..
Syrupus Ferri Phosphatis cum Quina et Strychnina.	Tablets of Easton's syrup.	..
Talcum Purificatum.	Raw material imported. For substitutes see under acidum boricum.	..
Tamarindus	..	India, Burma, W. Indies.
Taraxacum †	..	..

TABLE IV

*Identical substitutes of British manufacture*

Drug of foreign origin	Identical substitute	Drug of foreign origin	Identical substitute	Drug of foreign origin	Identical substitute
Acaprin	Pirevan.	Eumydrin	Atropinæ Methyl-nitras.	Myosalvarsan	Sulpharsphen- amina.
Anæsthesin	Benzocaine.	Euphyllin	Theophyllina cum Aethylenediamina (aminophylline).	Nembutal	Pentobarbital Sodium.
Atebrin	Mepacrinæ Hydrochloridum.	Evipan and Evipan Sodium.	Hexobarbitonum and Hexobarbitonum Solubile.	Novocaine	Procinæ Hydrochloridum.
Atophan	Cinchophenum.	Fouadin	Stibophenum.	Perabrodil	Diodone.
Atoxyl	Sodii Aminarsonas.	Germanin	Suraminum.	Plasmoquin	Pamaquinum.
Avertin	Bromethol.	Luminal and Luminal Sodium.	Phenobarbitonum and Phenobarbitonum Solubile.	Prominal	Pemitonum.
Bayer 205	Suraminum.	Medinal	Barbitonum Solubile.	Prontosil Album	Sulphanilamidum.
Benzedrine	Amphetamina.			Protargol	Argentoproteinum.
Cardiazol	Leptazolium of home manufacture.			Salyrgan	Injectio Mersalyli.
Coramine	Nikethamide.			Uroselectan B	Iodoxylinum.
Dial	Allobarbitonum.			Veronal	Barbitonum.
Dionine	Aethylmorphinæ Hydrochloridum.			Yatren	Chiniofonum.
Doryl	Carbacholum.				

## Public Health Section

## PHYSIOLOGICAL HYGIENE

FROM a public health point of view, the factors controlling human health can be classified under two main heads—internal and external. The internal factors include heredity and physique, the latter being determined largely by nutrition, and the external factors physical and social environments.

Individual health is to a great extent dependent on the individual's hereditary characteristics—physique, intelligence and aptitude. Similarly, racial health is, according to recent trends of thought, dependent on the application of certain eugenic methods. In fact, the science of eugenics is a 'study of the agencies under social control that may improve or impair the racial qualities of future generations', either physically or mentally; thus by an improvement of the social environment, the most important environment of man, the inherited qualities of the race are given the most favourable opportunities for the development of physical and mental health.

With regard to physique, it is well recognized that it is largely influenced by nutrition and this factor has been thoroughly investigated and the knowledge gained has been extensively applied in public health programmes. Thus, nutrition occupies a unique place between heredity on the one hand and environment on the other, influencing both equally forcibly.

Analysing the various external factors, one finds that nutrition, parental care during childhood, and good housing and sanitation are amongst the most important. Of these, undoubtedly nutrition again is the first and foremost individual factor in human health. Though some Swedish and Indian experts consider that even with a 'poverty' income adequate nutrition can be obtained if only the individual is taught how best to utilize the amount for purchasing the most nutritious foods, it is now admitted on the basis of extensive researches that the greatest single factor for the improvement of individual health (synonymous with national health) can only be a change in the economic system, whereby every individual in all classes of society is provided with an adequate minimum income which will enable proper and adequate nutrition to be obtained. The modern nutritionist thus defines nutrition in ideal terms rather than in terms of compromise.

With reference to other aspects of human environment, such as the physical environment, recent research has established their usefulness in the maintenance of the health of man. The work of Shapiro and Hulse\* on the Japanese

immigrants at Hawaii has shown, by quantitative anthropometric measurements, that even the dynamic human structure, in as short a time as one generation, is plastic to the influences of the physical environment.

The physical influences responsible for human comfort can be said to be the external temperature, humidity, air velocity and radiations from surrounding bodies. The researches of Herrington and his associates at the John B. Pierce Laboratory in New Haven, Connecticut, on 'partitioned calorimetry' have clarified many points on exchanges of heat in the human body under various conditions, and those of Cecil Drinker\* at the Harvard School of Public Health, Boston, have gone a long way towards bringing about a better understanding of the physiological principles in public health. The work of Yaglou† on the natural and artificial air conditions and that of the American Society of Heat and Ventilation Engineers at their Pittsburgh experimental station, who have evolved an 'effective temperature' chart that gives a numerical value to the combined air conditions, have widened our outlook on the scope and usefulness of air conditioning. Dufton's‡ 'equivalent temperature' index and the eupathioscope are tending to replace Leonard Hill's earlier katathermometer. These are only some of the instances where Science has attempted to conquer Nature, to the greater comfort and better health of the individual.

Occupation, the next social environment, is accepted as a factor of major importance. Occupation in relation to health has been the subject of intense scientific study since the last European war. These studies have gone to prove that physical and mental environment is as important as the constitutional make-up of the individual worker. Year by year, more information on industrial occupations is being accumulated. The industrial Fatigue Research Board (now known as the Industrial Health Research Board) have gone into minute details of the health and efficiency of the industrial worker under various conditions; fatigue has been eliminated and the physical efficiency of the workers enhanced to a great extent as a result of the proper control of work spells and rest pauses based on scientific study. The multiple shift system that is being followed under emergency conditions, as at present, is an outcome of the extensive researches done in this connexion.

\* DRINKER, C. (1937) .. *Symposium at the Harvard University Tercentenary Celebration.*

† YAGLOU, C. P. (1937) .. *J. Amer. Med. Assoc.*, **108**, 1708, and **109**, 945.

‡ DUFTON, A. F. (1933). *J. Hyg.*, **33**, 474.

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Apart from the researches of the Industrial Research Board, referred to above, modern industrial and warfare organizations have made it necessary for the scientist to investigate in detail certain biological problems; aviation medicine, for example, is to-day a well-recognized specialization brought into being to deal with the hazards peculiar to rarefied atmospheres and the high speed of aeroplanes. The great variety of synthetic chemicals that are manufactured has made industrial toxicology a prominent subject in industrial medical practice, and in some instances legislation has been introduced for the prevention of certain industrial hazards. Psychological medicine has also been called upon in the case of occupational selection and vocational training of the industrial worker and the treatment of his 'accident neurosis'.

Thus it is that the workers on many diverse subjects have in recent years played their parts in achieving the common object of enhancing the individual and national health by researches on the ever-changing human environment. These researches are now recognized as forming part of the new field of physiological hygiene.

It will be seen from this short résumé that physiological hygiene has developed into a vast science which can no longer be ignored by the sanitarian. It is on account of the recognition of its great importance that leading universities have created separate departments of physiological hygiene for the training of public health officers. The London School of Hygiene and Tropical Medicine has included the subject for the D.P.H. of the London University, and the American Universities have also endorsed its importance by giving degrees and instituting research courses on the subject.

In India, the All-India Institute of Hygiene and Public Health has followed the excellent example of the English and American universities and has recently, under the inspiration and guidance of its new director Dr. J. Grant, organized a physiological hygiene section. This we are sure will enhance the reputation and usefulness of the institute. The importance of this section can best be realized when it is remembered that the environment in the tropics differs from that in the temperate climates and that many of the advances made elsewhere cannot be applied directly in tropical countries, such as India, without further investigations on the subject. As an example may be mentioned the oft-quoted 'effective temperature index' of the American Society of Heat and Ventilation Engineers which is accepted as a criterion in many countries of the world. The recent investigations of the physiological hygiene section of the All-India Institute of Hygiene and Public Health have shown that this index is not completely applicable to Indian climates. The mechanism of heat regulation, as revealed by studies in experimental chambers in colder

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## AVAILABLE LIGHT IN A PUBLIC BUILDING

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and

D. N. MULLICK

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### *Purpose of the study*

RECENT researches show that nearly 60 per cent of human actions are based on visual impressions. These impressions are in turn dependent on lighting, either natural or artificial. One reads in an authoritative League of Nations' publication 'Suitable lighting leads to cleanliness of work places, postponement of fatigue, prevention of accidents, easier discipline and control, limitation of waste and better quality of work with more rapid production'. In addition, light influences people's frame of mind. Darkness and semi-darkness are associated with gloom and depression, whereas light creates an atmosphere of brightness, cheerfulness and high spirits. Alternatively it is common experience that damage to eyesight or eye strain and fatigue with consequent inefficient and slow work is caused by insufficient light at places of work. It is usual in building practice to design in such a way as to provide enough entry of natural light. This is stated as that 20 per cent of floor space should constitute the area necessary for windows, and is approved by public health engineers and officers. It of course goes without saying that all important public buildings have been planned in conformity with this principle. Even so have we any justification in assuming that at all places of work in these buildings enough light is provided according to the standard minimum illumination worked out at 10 foot-candles for office work and from 20 to 25 foot-candles for more delicate work as in laboratories? As far as we are aware no data on this point are available for any of the important buildings in India such as schools, factories, museums, institutes, etc. It was therefore decided that study of the illumination of a modern building will be useful and form a first contribution from the department of physiological hygiene. The results obtained, as will be seen later, are quite unexpected and seem to

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climates, is probably not applicable in its entirety to Indian conditions where the evaporative heat loss from the body is at work during the major part of the year, and where acclimatization has also to be taken into account.

By studying the conditions as they exist in the tropics, it will be possible to collect data on which new formulæ can be worked out or existing formulæ modified to suit these conditions.

justify a more systematic study of the problem in all public buildings. As it is we feel that enough light is not provided for the use of a large number of important workers in most important buildings devoted to work and study.

*Scope of the study.*—The observations are limited to 30 places of work in one building chosen for investigation. These observations were further restricted to office, record, labora-

up to 50 foot-candles and its sensitiveness is about 0.5 foot-candle. A cover for the sensitive cell is provided which permits of a limited fraction of light to its surface and enables the instrument to be used up to ten times the normal range, or 500 foot-candles. The instrument is light and portable and is placed on the table or work bench where illumination is to be measured and readings are made immediately.

TABLE  
Showing light measurements in foot-candles

Number	Place of work	7 a.m.	10 a.m.	12 noon	2 p.m.	4 p.m.	6 p.m.	8 p.m.
OFFICE :								
1	Head clerk .. ..	1.5	42.0	12.0	10.0	4.0	2.0	2.5
2	Stenotypist .. ..	1.0	33.0	6.5	6.0	6.5	1.0	1.0
3	Despatcher .. ..	2.0	8.0	3.5	2.5	3.5	1.5	1.5
4	Cashier .. ..	2.0	3.0	2.0	4.0	3.0	1.5	1.5
5	Accountant .. ..	2.0	14.0	10.5	30.0	35.0	1.0	1.0
6	Typist I .. ..	4.0	20.0	14.0	21.0	30.0	1.5	1.5
7	" II .. ..	4.0	8.0	9.0	17.0	25.0	1.6	2.0
8	" III .. ..	1.5	4.0	5.0	11.0	18.5	1.0	1.0
9	Clerk I .. ..	2.0	5.0	5.0	9.0	14.0	1.0	1.0
10	" II .. ..	..	16.0	4.0	3.0	2.5	1.0	1.0
11	" III .. ..	1.0	20.0	5.0	3.0	3.0	0.5	0.5
RECORD ROOM :								
12	File room clerk .. ..	6.0	3.0	5.0	10.5	9.5	2.0	2.0
13	" dufttry .. ..	..	0.5	2.0	3.5	2.5	0.5	0.5
LIBRARY :								
14	Librarian .. ..	23.0	70.0	70.0	70.0	47.5	0.5	0.5
15	Assistant librarian .. ..	13.5	25.0	37.5	33.0	36.0	1.0	1.0
16	Study table (north) .. ..	4.0	9.0	15.0	14.0	12.0	0.5	0.8
17	" " (south) .. ..	1.0	6.0	6.0	6.5	5.0	1.0	1.0
18	" " " .. ..	0.5	3.0	7.0	7.5	6.5	1.0	1.0
19	" " " .. ..	0.5	2.0	2.0	1.5	1.5	0.0	0.0*
LABORATORY :								
20	General laboratory (north) .. ..	25.0	60.0	85.0	85.0	80.0	0.0	0.0
21	Laboratory table (north) .. ..	20.0	50.0	60.0	80.0	75.0	0.0	0.0
22	" " (south) .. ..	1.0	5.0	6.0	6.5	4.0	1.5	1.5
23	" " " .. ..	1.0	4.5	6.0	8.5	3.5	2.0	2.0
24	Laboratory assistant table (south). .. ..	1.5	6.0	7.5	8.5	3.5	1.0	1.0
25	Laboratory assistant table (north). .. ..	3.5	5.0	10.0	10.0	8.5	1.0	1.0
26	Chief's room (north) .. ..	31.5	60.0	75.0	80.0	75.0	1.5	1.5
27	" " " .. ..	20.0	60.0	70.0	70.0	75.0	1.0	1.0
28	" writing table .. ..	5.0	10.0	12.0	13.0	10.0	2.0	2.0
29	" room (south) .. ..	1.5	5.0	8.0	10.0	3.5	0.5	0.5
30	Artist .. ..	4.5	33.0	35.0	22.0	19.0	..	..

\* Readings 0.0 indicate light values of less than 0.5 foot-candle.

tory, library, and artist's room. The illumination in these rooms was tested at the following hours 7 and 10 a.m., 12 noon, 2, 4, 6 and 8 p.m.; 210 observations were made in the month of March 1940.

*Methods.*—All the illumination measurements were made by Weston's photronic metal oxide rectifier type of self-exciting cell, Model E 703. It is named a 'lightometer' by the makers and has an indicator which reads directly in foot-candles. The normal range of the instrument is

*Results.*—The data obtained are collected in the table attached. The figures are foot-candles of light available at the hours mentioned.

#### Discussion

(1) *Office.*—For office work the minimum light requirement is given as 10 foot-candles, and for fine work as 20 foot-candles. Considered from this standpoint, out of 77 observations at 11 positions, only 19 observations are above 10 foot-candles and 9 above 20 foot-

candles. It is particularly pointed out that the cashier and the despatcher who for obvious reasons should be provided with at least 10 foot-candles or better 20 foot-candles, only have the ridiculously low figures of about 3 foot-candles all the time they are at work. If they make mistakes they have justification for it.

It is also to be noted that after darkness has set in the illumination under artificial light is at the extremely low value of from 0.5 to 1.5, suitable only for corridors and other such places. Yet members of the office staff quite often work late into the night.

(2) *File room*.—Here again the place is very badly lighted. An observation as high as 10.5 foot-candles was only once obtained. Needless to say efficient filing of records is not possible under such circumstances.

(3) *Library*.—The table where reading is done is below standard requirements. At night the light values are from 0.5 to 1.0. This should give rise to severe eye strain and is certainly unhygienic. Many have felt difficulty in reading in the library and it never struck them that it would be profitable to investigate the cause. With the library open till 9 p.m. the question of better illumination should immediately be considered.

(4) *Laboratories*.—The south end of the work tables where in fact the workers usually work is inadequately lighted. Work is impossible at night with only 1.0 foot-candle.

(5) *Artist's room*.—This is the only place with proper illumination and even here at 7 a.m. it is low.

In giving standards of lighting required for various kinds of work we are dependent on the results obtained in European countries, England for example. It is doubtful if these standards are applicable to India. In a discussion of the thermal comfort zone for men the standards necessary in sub-tropical climates worked out in those countries is by no means applicable here.

We have evidence of the phenomenon of acclimatization; in a similar manner there is every possibility of adjustment to illumination sensitivity as well. In our climate we are provided with far more intense natural light for much longer periods of the day than obtains in Europe. It is just possible that we need more light for our work than those in sub-tropical or arctic regions will require. This is a problem needing study before recommendations can be made.

*Conclusion*.—It appears that while window-space is of proper amount, enough light is not available for ensuring efficiency at many places in the building investigated. It may be that no rational or scientific methods have been followed in locating the tables of workers. It may be that partitions or almirahs are placed in the wrong place and obstruct light. The artificial light fittings at present provided are quite inadequate for any kind of work.

*Discussion*.—The need for provision of increased light is evident particularly in the evenings and at night. A good deal of work has been done on the (1) efficiency of work, (2) turnover of production, and (3) freedom from mistakes in well-lighted buildings and factories. This suggests the desirability of considering methods for provision of increased lighting. It would involve increased outlay of capital in providing powerful lighting installations as well as increased expenditure on fuel for lights—paraffin and gas or electrical energy. To administrators the question that will arise is whether this extra expenditure is justifiable. In an investigation conducted in a tile-pressing factory 'the old illumination of the order of 1.2 foot-candles was increased to about 3.5 foot-candles or roughly three times for about 80 per cent increase in the electrical energy consumption. The increased consumption however resulted in a 6 per cent increase in efficiency and turnover. The lighting cost frequently does not exceed 1 per cent of the pay roll. The increased illumination appears to be justified on economic grounds alone, apart from the satisfaction which it affords the workers'.

These figures were obtained at a time when production of lights had not progressed much beyond Edison's original discovery of the glowing bulb containing a charred bamboo fibre. As recently as 1932 great strides have been made in the technique of light production with discharge lamps of mercury and sodium. The future of illumination seems to be in this direction for several reasons. One reason is that three times more light is produced for the same amount of wattage from discharge lamps compared with that from filament lamps. This will be particularly appreciated with higher wattages essential for modern times. During the last two years another major revolution in ideas on illumination has taken place in the introduction of what is known as 'blended lighting'. In this system mercury vapour lamps and sodium vapour lamps are fixed under the reflector with the result that the mixture of red end and blue end of the spectrum give a bluish-green light indistinguishable from natural light. At this wave-length the retina is most sensitive so that with this blended light far less intensity of light is necessary than with filament lamps. It is a further advantage that there is less strain on the eyes.

The latest improvement is the fluorescent discharge lamp, where use is made of ultra-violet energy which by itself is invisible and absorbed in the glass wall. By lining the inside of the lamp with fluorescent material, the wasted ultra-violet energy produces the valuable fluorescent light and thus further increases the efficiency of the discharge lamps.

One almost feels that we have reached the ideal. It was thought so even when ordinary electric lights banished the evil-smelling and smoky oil and gas burners.



## MATERNITY AND CHILD WELFARE

## THE SCHOOL TEACHER AND CHILD WELFARE

By L. S. GHOSH, W.M.S.

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IN recognition of the fact that the civic or community standard of living cannot be higher than that desired and practised by the great bulk of the individuals making up the community, the term 'health education' has come into common use to cover instruction in both the personal and community aspects of hygiene.

The child in school becomes for the first time a member of a group other than his home circle. Through his contacts with other children and his teachers during play and study he meets many of the problems which later on a larger scale he will face as an adult. What is it possible to teach him?

He can be taught what each citizen, both in his home and in his outside sphere of activity, can do to make health appreciated. He can be taught to realize that health is a contribution towards success in life, family happiness and the enjoyment of good civic amenities in his village or town. The older child can be taught that good health is cheaper than sickness, that permanent disabilities which follow many diseases limit the opportunities and earning capacity of the victims, that the protection of health is not an expensive fad but an economic asset, that money well spent by the community for this purpose saves the individual's purse. The school child can also be trained to habits which will automatically make him desire and demand a more healthy way of living for himself and his community.

The close relationship between the civic and personal aspects of hygiene can be seen in the following three examples:—

Let us take first the habit of spitting. Only by training the individual not to spit on floors and pavements can the cleanliness of houses and streets be improved and something effected towards the control of diseases, like tuberculosis, which are spread by germs in the sputum. Laws laid down by local bodies can be rendered quite useless by the individual consistently disregarding them.

Secondly, let us consider the ever-running water tap. Enormous wastage of water occurs by public taps and taps in houses constantly running. Water is precious in most parts of India, but only by personal habitude to turning off taps after use can water be conserved for drinking and bathing and domestic purposes. Many buildings and structures also will be saved from unhealthy dampness and infection by the proper handling of water taps.

Thirdly, let us consider the problem of unclean food sold in the streets. The child in

whom is created a distaste for food exposed to flies and dust, or food carelessly handled, will tend to carry that distaste into adult life. Conditions for the improvement of preparation and public sale of food and sweets are more likely to develop quickly by the individual refusing to buy anything but clean food than by regulations or legislation.

That is the case for the teacher. But is the future of health training in the teachers' hands alone?

It would be a mistake to imagine that it is—the home must be considered to influence the child at least as much as the school. The greatest difference between the two influences is that that of the teacher in India is still largely bookish and theoretical, while in the home, habits are insensibly formed by practice and custom. To talk in school of clean food, when daily the child sees no precaution taken at home, can leave little bias in favour of hygienic practice.

To be successful, therefore, health education in schools must mean—(1) practice rather than lessons with the child as the individual and the class as the community; (2) that a teacher has some knowledge of and contact with the parents and home of the child; (3) that the child is given opportunities to visit the various institutions and organizations set up by the local body for purposes of hygiene, such as the water works, sewage works, the refuse disposal, food shops, and, in large towns, museums where models are shown.

Let us consider how the first requirement can be met, that is, how hygiene can be taught by practice rather than by lessons from a book. This routine exacts a great deal of tact and enthusiasm from the teacher and it necessitates the following of a carefully planned scheme of work.

Each child should make and keep a health diary. The type of diary may vary with the economic circumstances of the child and the type of school, but in its simplest form it need only be a long sheet of white paper pasted on cardboard and ruled into vertical columns, each one representing one phase of hygienic practice; for example, 'I bathed and turned off the water tap afterwards'; 'I cleaned my mouth'; 'I brushed my teeth'; 'I used the latrine and washed my hands afterwards'; etc. Horizontal lines are drawn to divide the columns into daily compartments, a date for each day being written down the left-hand side of the diary.

The teacher, as soon as the child arrives in school, must examine him and allow him to fill in his diary. She must scrutinize his hands, hair and general toilet and for each item on the diary complied with, a disc of red paper or a mark made with red pencil can be put in the corresponding compartment. Fifty such red marks earn a golden disc or a yellow mark and rewards either in the form of a post of responsibility in

one case, within 72 hours in 2 cases, and in the remaining 4 cases after 4, 6, 7, and 24 days, respectively.

There is positive evidence from the above summary to show that the chances of recovery are adversely affected by age, severity of disease, late diagnosis, and the presence of a coincident grave illness, and that death may occur before M. & B. 693 can be therapeutically effective. Although only one patient died within 24 hours, 2 others were moribund on admission and treatment was given without hope of success. At that time M. & B. 693 soluble was not available, but it is unlikely that the patient who succumbed in 10 hours could have been saved by any treatment; in the 2 other cases parenteral M. & B. 693 might have succeeded where oral administration had failed. Early administration of M. & B. 693 soluble might also have been of value in some of the other cases. One patient received an inadequate initial dose (3 tablets, *t.d.s.*) and 3 other cases might have stood a better chance of recovery had four-hourly administration of the drug been continued after the first 24 hours.

### Discussion

A review of 274 cases of lobar pneumonia treated with M. & B. 693 showed that with adequate dosage of the drug, the majority of cases may confidently be expected to respond within 48 hours of the beginning of treatment. An analysis of the 40 cases provisionally classified as 'indefinite or absent' response demonstrated that persistence of pyrexia beyond 48 hours, or relapse, need not indicate ineffectiveness of the drug, indeed, although the dose was considered inadequate in many cases, it was concluded that M. & B. 693 acted beneficially on the course of the disease in 23 cases, and may have prevented death in 5 other cases. The drug appeared to be ineffective in 17 cases (6 per cent of the total treated), but of these cases 4 received an inadequate initial dose (2 tablets, *t.d.s.*); 2 died within 36 hours of admission to hospital and one died of myocardial degeneration. Complications were conspicuously uncommon, delayed resolution occurred in 6 cases and in one case a staphylococcal empyema developed.

The importance of the following factors in influencing the response to treatment was also demonstrated :—

The response was less satisfactory in patients admitted after the 4th day of the disease, thus stressing the importance of early diagnosis and treatment. Age over 40 and severity of disease on admission adversely affected the mortality rate, but did not appear to affect the response to treatment in the other cases.

When toxæmia was sufficiently severe to cause death within a few hours after admission to hospital, treatment was not unexpectedly ineffective. In the present series one patient died within 10 hours and one within 36 hours, in

these cases death probably occurred before M. & B. 693 could exert its full therapeutic effect. Lack of realization by the coolie of the importance of early treatment will continue to swell the mortality figures of lobar pneumonia in spite of M. & B. 693 therapy. The remedy lies more in education of the public than in chemotherapy. On the Kolar Gold Fields most of the coolies are under strict supervision and daily inspection of the lines excludes the possibility of a sick coolie remaining in his quarters until his condition becomes hopeless (both patients who died soon after admission to hospital came from the surrounding villages). The introduction of M. & B. 693 soluble should improve the chances of recovery in moribund patients; all gravely ill patients should be given an initial dose of 3 c.cm. (1 gm.) intramuscularly repeated if necessary at two or four-hourly intervals until the condition of the patient sufficiently improves to permit oral administration of the drug.

Intercurrent disease influenced the outcome in 2 patients, one succumbed to congestive cardiac failure secondary to myocardial degeneration and in one other fatal case diabetes and cardio-renal disease were contributory factors. It is equally important to note that 3 patients admitted with signs of congestive cardiac failure responded excellently to M. & B. 693. Severe intercurrent disease, especially myocardial and renal disease in elderly people, will continue to enhance the mortality rate in lobar pneumonia, but many of these cases can be saved by efficient M. & B. 693 therapy.

Faulty administration of M. & B. 693, either in quantity or spacing of doses, was undoubtedly the most important factor in poor or absent responses. This was well demonstrated by the higher proportion of less satisfactory responses in the 18 cases treated with initial doses of 2 tablets, *t.d.s.*; table VII shows that no case responded within 12 hours, and only 66.6 per cent responded within 48 hours compared with 86.7 per cent in the remaining 256 cases treated with higher initial doses.

TABLE VII

*Fall in temperature after commencement of treatment in 18 cases treated with M. & B. 693 2 tablets, t.d.s.*

Within 12 hours	..	0
" 24 "	..	6
" 36 "	..	5
" 48 "	..	1
More than 48 hours	..	5

The practitioner in some cases has to consider the expense of treatment, but the cure of disease should always come first and if a drug is indicated it should be given in effective doses. The strikingly satisfactory response of a few cases of lobar pneumonia to small doses of M. & B. 693 (such as 2 to 4 tablets daily) is very impressive,

but to expect all cases to respond in this manner is to court disaster. The dose of M. & B. 693 considered to be adequate has already been fully discussed, it is appreciated that 9 gm. during the first 24 hours is open to criticism as being too high for the average case and that many patients would respond to smaller doses, but unfortunately there are no criteria (apart from gravity of illness) to assist the practitioner in detecting the type of case requiring maximum dosage. An appreciable number of mildly or moderately ill patients will respond only to massive dosage. It is felt that the danger of under-dosage is greater than over-dosage and it is safer to give a dose which will be effective against the more resistant strains of pneumococcus. In this respect it is important to remember that in lobar pneumonia massive doses of M. & B. 693 rarely need be continued for more than 36 hours and usually the drug can be stopped in 48 to 72 hours. The possibility of severe drug toxicity is thereby minimized, clinical experience has shown that mild toxic symptoms are of little significance, but the danger of drug resistance following inadequate initial doses is a real one.

The analysis of the 'indefinite or absent' responses proves the necessity not only for an adequate initial dose but also for an adequate maintenance dose and four-hourly administration of the drug at all times. A secondary rise in temperature in certain cases (group 2) was probably due to the dose of M. & B. 693 being too rapidly reduced after the first 24 hours, and it is hoped that the administration of 2 tablets, *q.q.h.*, continued for about 8 hours after the temperature has fallen to normal will do much to eliminate these cases. It has been recommended that when the patient has been afebrile for 8 to 12 hours, in the majority of cases 1 tablet, *q.q.h.*, need only be continued for a further 24 hours, this period may be considered too short, but there does not appear to be any indication for routine prolongation of the administration. Premature withdrawal of the drug may give rise to a recrudescence of symptoms, and it is possible that the recurrence of toxæmia and pyrexia in certain cases in group 1 might have been due to this factor; all these cases, however, responded extremely well to increased doses of M. & B. 693, and it is concluded that as long as the patient is carefully observed there is little danger in this respect.

Type I pneumococcus appeared to be more resistant to M. & B. 693 than other types, this was not only a clinical impression but was also supported by the comparatively high incidence of type I pneumonia in the deaths (33.3 per cent). An investigation into the type of lobar pneumonia occurring on the Kolar Gold Fields has shown that about 15 per cent were due to type I, but as the investigation was not complete undue importance is not attached to

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## INCIDENCE OF LEAD POISONING AMONG HINDU WOMEN AND CHILDREN

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In connection with a series of investigations (under the Indian Research Fund Association) on the lead contents of human excreta, tissues and hair, it was discovered that hair of Hindu women, particularly of those who are married, is exceptionally rich in lead (*vide* table I) and the urine and faeces of some of the women whose

TABLE I

Average lead-content of hair in different nationalities. Figures indicate mg. of lead per kilo (Bagchi, Ganguly and Sirdar, 1940).

Nationality	Men	Women
Europeans (including Jews and Anglo-Indians).	20.8	18.4
Indians ..	28.0	114.5
Bengalee Hindu ..	26.7	180.9
Bengalee Mohammedan ..	42.4	50.4
Punjabee ..	20.2	45.5
Madrassee ..	22.7	..
U. P. and Bihari ..	21.6	..

hair gave high lead figures were found to contain large quantities of lead—much larger than in the

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these figures and they are recorded without comment.

### Summary

1. Two hundred and seventy-four cases of lobar pneumonia treated at the Kolar Gold Fields Hospital have been reviewed.

2. The mortality rate was 3.2 per cent.

3. The administration and adequate dosage of M. & B. 693 in lobar pneumonia have been discussed.

4. Forty cases (15.5 per cent) not responding to M. & B. 693 within 48 hours have been analysed with reference to causative factors.

5. The drug appeared to be ineffective in 17 cases (6 per cent) but in 6 of these cases other factors might have influenced the response to treatment.

6. The importance of adequate dosage has been emphasized as the most important factor in delayed or absent responses.

I wish to acknowledge my thanks to the managers of the Kolar Gold Fields, Messrs. John Taylor and Sons, 6, Queen Street Place, London, E.C.4, for their permission to publish this paper, and to the Chief Medical Officer, Dr. W. B. Roantree, for his valuable criticisms.

excreta of those who gave low lead figures in their hair (Bagchi *et al.*, 1940).

As these women, mostly belonging to the upper middle class, were not connected with any industry necessitating exposure to lead, an attempt was made to trace its source and the route by which it is introduced into the system. Candy (1933) states that the plating or 'tinning' of cooking and storing vessels with tin-lead alloys is the principal source of lead in cases of lead poisoning in India. Several samples of tin alloys which the tin-smiths use for tinning 'dekchis' (cooking utensils) were collected from different parts of Calcutta and examined, but none of them was found to contain an appreciable amount of lead. Similarly, the aluminium vessels and glazed surfaces, collected from cheap porcelain, earthenware and enamelled vessels, were examined and found to be practically free from lead. But these sources, even if they contained lead, could not possibly affect only the women and spare the men of the same family, for every one of them was exposed to the same extent to this risk. Attention was therefore directed to other sources which usually claim the exclusive attention of women, *viz.* the scented hair oil, powder, creams and snows, vermilion, etc., and it was found that the vermilion used by married Hindu women was responsible for such state of things. Genuine vermilion, a more expensive stuff, is pure red sulphide of mercury imported exclusively from China and is known as 'China sindur' or Chinese vermilion, while the other brands of vermilion, some of them being scented for fashionable women and selling under various trade names, are nothing but red lead mixed with a red synthetic dye. Some of these dye-stuffs being powerful irritants damage the epithelium and produce roughness on the hair-parting where vermilion is applied.

It is known that lead is absorbed, though sparingly, through the unbroken skin and cases of lead poisoning have been known to follow the use of hair-dyes, lotions, cosmetics and grease paints containing lead. It has also been proved experimentally on laboratory animals by American workers (Kehoe and Thamann, 1931). The application of red lead to the scalp (anterior end of the hair-parting) by Hindu women is therefore a source of abnormal lead risk. The use of hair oil, which is common even amongst the poor, helps to hold the lead in contact with the scalp by forming lead soap with the fatty acids of vegetable oils and thus favours absorption, especially if the epithelium of the scalp is damaged. Besides the absorption of lead by this route, there is also a probability of its absorption through the alimentary or the respiratory tract as well, on account of careless handling and unavoidable spilling of the substance at the time of its application. This is borne out by the fact that little children, specially the girls, living in close association with their mothers, imbibe an appreciable

amount of lead in their system (Bagchi *et al.*, 1940), although they do not use any vermilion (*vide* table II).

Since vermilion containing lead is used by a large proportion of Hindu women and since an

TABLE II

*Lead-content of hair of members of certain Bengalee Hindu families where vermilion is used (Bagchi et al., 1940).*

Family members	Age	Amount of lead in hair (mg. of Pb per kilo)	Using vermilion or not
Husband ..	34	34.0	Not using.
Wife ..	30	242.0	Using.
Brother ..	31	27.0	Not using.
Sister ..	30	302.0	Using.
Son ..	7	9.0	Not using.
Daughter ..	3½	74.8	Do.
Mother ..	28	284.0	Using.
Daughter ..	12	105.0	Not using.
Nephew ..	18	27.0	Do.
Do. ..	15	16.5	Do.
Do. ..	13	16.5	Do.
Do. ..	11	15.0	Do.
Husband ..	49	13.5	Not using.
Wife ..	40	503.3	Using.
Daughter ..	22	84.0	Not using.
Do. ..	19	122.0	Do.
Do. ..	17	108.0	Do.

equally large number of children, who may be called 'contacts', are liable to imbibe lead through the other routes, incidence of lead poisoning is likely to be high among Hindu women and children but in actual practice no such cases are met with and so far no cases have been reported. This is perhaps due to the fact that by the expression 'lead poisoning', we always try to visualize the typical cases of plumbism with wrist-drop, anaemia, colic, obstinate constipation, blue line on the gums and other characteristic signs and symptoms, but which we never find. The apparent absence of lead poisoning may be accounted for by the following possibilities:—

(i) The dose of lead is perhaps too small and its absorption goes on *pari passu* with its elimination through the usual eliminatory channels including hair, (ii) the Hindu women and children are not susceptible to lead, or (iii) the signs and symptoms of chronic lead poisoning differ widely, under different conditions, from the classical signs and symptoms described in the textbooks.

It is believed that women are more susceptible to the action of lead, although this view is not shared by the German writers who consider that 'their poor state of nutrition, poverty and industrial fatigue added to house work, long hair and type of clothing favouring the accumulation of a greater quantity of the poison upon them' account for an 'apparent

increased susceptibility (Biondi, 1934). But all agree that in women, lead poisoning assumes a more severe form and menstrual disorders are very frequent (Biondi, *loc. cit.*). This is the state of things in European countries and amongst women who are directly connected with various lead industries, but the poor state of nutrition, poverty and few other conditions stated above may apply with greater force to Indian women, and they cannot possibly escape lead intoxication, however it is introduced into the system.

It has been proved that lead is absorbed in larger quantity and much more quickly through the lungs than through the skin, or the alimentary tract and produces the characteristic symptoms of poisoning. Even then, only few of the employees in lead works, where lead is likely to be introduced through the lungs, develop the symptoms, while others develop a relative immunity. The Hindu women expose themselves to the poisonous action of red lead for years together and some of them give definite proof of lead absorption as indicated by high lead-content of their urine and faeces (*vide* table III), but they never develop the textbook

symptoms. Bulky food, as taken by the average Indian, is known to interfere with absorption of lead ingested with food (Monier-Williams, 1938), therefore a portion of the vermilion that happens to be introduced into the gastro-intestinal tract is not completely absorbed through this route and does not furnish the extra doses of lead necessary to effect sufficient damage to the tissues for production of the characteristic symptoms. It has been stated (Porritt, 1931) that 'a slow, subtle, insidious saturation of the system by infinitesimal doses of lead extending over a long period of time produces a group of symptoms altogether different from the recognized forms of plumbism', while the massive doses of lead, as introduced mostly through the respiratory and alimentary tracts, produce the classical lead poisoning of the textbooks (compare groups II and III in table III). On the basis of the above statement we may reasonably expect that, if lead poisoning occurs at all, the insidious type may be the prevailing form among Hindu women and children.

#### *Pathology and symptomatology of the insidious type*

The signs and symptoms of the insidious type of poisoning are, in most cases, those of dyspepsia, such as loss of appetite, distaste for food, slight constipation, sometimes looseness of bowels with mucus (enteritis saturnina), flatulence, abdominal discomfort bearing no definite relation to food, and slight anaemia. In many cases arthralgic pains round various joints—the knees, elbows and shoulders being most frequently affected—are the only symptoms available (Price, 1929). In some cases arthritic pain with creaking or grating and impairment of movement and sometimes with slight swelling of a joint, may be present. Symptoms simulating gastric ulcer or malignant gastric disease with diarrhoea, vomiting and abdominal pain, but without haematemesis or melæna have been recorded (Bramwell, 1931). Vertigo, headache and insomnia may also be the only symptoms (Price, *loc. cit.*). Lethargy, weariness of brain, sleepiness, disinclination for any effort with emotional outbursts, especially in women, mental confusion and 'bright girls becoming gloomy, taciturn and miserable' with no other indications for lead poisoning have been known to be the characteristic features in the insidious type of poisoning (Porritt, *loc. cit.*). Neurological manifestations, such as weakness of the extensors of the right hand, lower arm, the interosseus muscles and also of the shoulder muscles (Leschke, 1934), spastic paraplegia, anterior crural neuritis with anomalous symptoms, and a mild form of lead encephalopathy with symptoms of brain tumour (Bramwell, *loc. cit.*) have been recorded. A case of lead encephalopathy with mental confusion, paraplegia and paræsthesia was reported by Candy (*loc. cit.*). The man fell down unconscious on the road, and

TABLE III

*Comparative statement showing the lead-content of urine and faeces (i) of healthy persons not exposed to lead, (ii) of women using vermilion and (iii) of men engaged in lead industries: mg. of Pb per kilo (Bagchi and Ganguly, 1937)*

	Urine	Faeces	REMARKS
Group I. Healthy Hindus (not exposed to lead).	0.016	0.14	Only the maximum figures given.
Group II. Hindu women using vermilion:—			
Case 1 ..	0.059	1.29	Suckling mother, quite healthy.
Case 2 ..	..	1.05	Dyspeptic troubles and anaemia (a six-year old girl).
Case 3 ..	0.02	1.04	Abortions with negative W.R.
Case 4 ..	0.008	1.525	Dyspeptic troubles and mild alopecia.
Case 5 ..	0.03	0.88	Mild alopecia, otherwise healthy.
Group III. Compositors and solderers:—			
Case 1 ..	0.06	2.4	Most of them suffering from lead poisoning with characteristic signs and symptoms of the textbooks.
Case 2 ..	0.124	1.05	
Case 3 ..	0.144	4.46	
Case 4 ..	0.364	2.28	
Case 5 ..	0.530	4.50	

remained so for 3 days. He made a rapid recovery under treatment for lead poisoning.

Menorrhagia and metrorrhagia have been known to be the principal signs in some cases. A married girl, mentally incoherent (duration one year) with slight spastic paraplegia and nystagmus (8 months), severe menorrhagia and metrorrhagia (4 months), and a history of abortion 2 years ago was successfully treated by Candy for lead poisoning. Frequent abortions and sterility are very common among lead workers. A woman who had previously given birth to three normal children, had nine miscarriages after her employment as a lead worker, and in a type-founding works half of the married women were sterile (Leschke, *loc. cit.*). Lead increases the incidence of eclampsia—the quantity of lead imbibed daily may be insignificant, but it 'may be enough to turn the scale and precipitate the occurrence of eclampsia in a pregnant woman on the verge of toxæmia' (Porritt, *loc. cit.*). High maternal mortality is significant among women exposed to lead.

Lead damages the kidney, and interstitial nephritis with arterial disease is common in cases of lead poisoning; but nephralgia simulating passage of gravel through the urinary organs is not uncommon (Porritt, *loc. cit.*). High blood pressure is neither an essential sign nor an immediate consequence of lead poisoning. It is a complication arising only in small percentage of cases, probably owing to 'a special disposition of the blood vessels or damage to the centre for blood pressure in the mid-brain' (Leschke, *loc. cit.*). As cases of high blood pressure are occasionally noticed among Hindu women, the question of lead poisoning may be carefully considered. In many cases subnormal blood pressure (80 to 100 mg. of Hg.) has also been recorded.

Vascular spasm is an important effect of lead absorption and its manifestations may be noticed in various forms in different organs of the body. The vessels lose their dilatability and no longer dilate even with caffeine, nitrites, etc., but, paradoxically, are decreased in size by these drugs (Leschke, *loc. cit.*). No blood vessels escape the effects of lead. The splanchnic, renal, retinal, as well as the blood vessels of the brain, may be equally affected. These spasms are at first functional but may gradually bring about permanent pathological changes. The clinical signs of vascular spasm are manifested by slow hard pulse, increased blood pressure, contracted kidney, spastic constipation and pains in the abdomen varying from slight discomfort to violent colic. The spasm of the retinal vessels gives rise to transitory or even permanent blindness and that of the brain vessels causes an encephalopathy which may vary in intensity from simple mental incoherence, sleeplessness, headache or nervous exhaustion to epileptiform fits and unconsciousness. The coronary vessels are also affected and angina pectoris or heart cramps which develop as the result of a purely

functional coronary spasm may be the only symptom. It may, however, lead to permanent changes, such as sclerosis and thrombosis, observed in cases of the classical type of lead poisoning.

Chronicity of spasms in the blood vessels of the hair follicles of the scalp may cut off nourishment and thus give rise to falling out of hair which is a common complaint among Hindu women and may be a manifestation of the insidious type of poisoning.

#### *Lead poisoning in children*

If a mother suffering from lead poisoning suckles her baby, she is likely to transmit lead through her milk and set up a slow and progressive poisoning in the child (Biondi, *loc. cit.*). Lead affects children equally badly and in insidious cases only the gastro-intestinal symptoms may be present (Taylor and Schram, 1936). The relative immunity of children advanced by some authors is without any foundation. The children born of mothers suffering from plumbism are less healthy and frequently undersized and weakly, and are 'prone to be degenerate showing macrocephaly, idiocy, imbecility and epilepsy' (Biondi, *loc. cit.*). Congenital debility in infants, marasmus, wasting, convulsions, obstinate constipation or enteritis with or without jaundice are frequently traced to lead intoxication and may be the cause of death of a large number of children (Milligan, 1931).

It may be contended that the use of red lead as vermilion is in vogue, in Bengal at least, for several decades past, but why it is incriminated now as the cause of so many ailments in women and children? The solution of this problem may be found in the researches of several workers on this subject. It has been experimentally proved that the type of diet exerts profound influence on absorption of lead. Milk, for example, retards its absorption considerably from the gastro-intestinal tract (Miyasaki, 1930). It was the principal article in the dietaries of the Hindus but poverty and expensive living in cities where people are migrating in large numbers, preclude its inclusion, in these days, even in the menus of children. This is one of the many important reasons to account for more absorption of lead leading to deterioration of health and development of the symptoms of poisoning.

#### *Diagnosis and discussion*

The physician cannot be blamed in any way for his inability to diagnose the insidious cases of lead poisoning as its possibility is not expected and never suggests itself. In some cases the physician may suspect lead as the cause of the clinical picture but a definite conclusion is difficult if the source of lead is not traced. The mistakes in the diagnosis of lead poisoning are often due to not expecting it (Bramwell, *loc. cit.*). In classical type of lead



poisoning with characteristic signs and symptoms, diagnosis is not difficult, but one should not expect to find punctate basophilia (stippled erythrocytes) in blood or the blue line on the gums, which are believed to be infallible signs of plumbism. In fact, the punctate cells have, so far, not been detected by competent pathologists in any of the typical cases of plumbism with wrist-drop, optic atrophy, violent colic, etc., among the compositors and solderers of Calcutta who were brought to my notice in connection with the administration of the Workmen's Compensation Act. The blue line may be an important and early sign on the pink gums of white people, but, on the dark or purple gums of an Indian, its identification is not easy, more so if the gums are stained with pan juice, tobacco preparations, *mishi* (astringent powder), etc. The blue lines or blotches are due to sulphide of lead, produced by the action of sulphuretted hydrogen, formed, as the result of putrefaction of food materials in the interdental spaces or around the teeth, on lead present in the gum tissue as an albuminate. It is, therefore, not found in people who are toothless or who take particular care of their teeth. Even in Europe, these signs are found only in a small percentage of cases. The type workers of Moscow developed the blue line only in 5.5 per cent and punctate basophilia in 13.3 per cent of the cases of lead poisoning (Leschke, *loc. cit.*). Harris (quoted by Biondi) could detect the basophilic cells only in 20 per cent of his cases. Kehoe (*loc. cit.*), on the other hand, states that the 'mere occurrence of stippled erythrocytes in the blood is not indicative of abnormal lead absorption and that the mere demonstration of stippling has no diagnostic value. The stippled erythrocytes are of frequent occurrence in the blood of persons who are apparently normal and healthy and who are free from abnormal lead absorption'. As this subject is still in a chaotic state, it is safer to ignore it altogether especially if the finding is negative.

In the insidious type of poisoning these signs are not to be expected. The other symptoms, already described, are often so ambiguous and simulate so many common ailments having no relation to lead, that the possibility of a correct diagnosis is always a remote one. Sir William Gowers (1893) stated, in connection with diagnosis of obscure cases of nervous diseases with anomalous symptoms, that 'it is not possible to avoid error in such cases except by the habit of remembering lead as a possible cause in obscure cases'. The dyspeptic symptoms which are often due to unbalanced diet, protozoal or helminthic infection of the gut, or some other tropical diseases, cannot be expected to be ascribed to lead if the physician does not know that his patient is exposed to an abnormal lead risk. The anaemia, abdominal discomfort, enteritis, constipation, etc., indicate so many diseases in the tropics that to remember lead as a possible cause for such ailments appears to

most of us to be a far fetched idea. Miscarriage and menstrual troubles are frequently attributed to specific infections, vitamin-E deficiency or to displacement of the uterus, even in the absence of a definite proof by blood test or by actual examination of the pelvic organs. As this country is industrially extremely backward, and as women, especially those belonging to the middle class and also those living in the countryside, have nothing to do with any industry, the question of occupational or industrial lead poisoning never arises and the physician would naturally think of all other conditions except plumbism.

The facts that women use vermilion and vermilion contains red lead should always be remembered. The obscure cases of anaemia with dyspeptic symptoms not yielding to treatment are so common, even amongst well-to-do Hindu women, both in cities and in the country, that a careful investigation about the aetiology of this condition with special reference to lead is called for. As some of these cases are associated with childbirth, the symptoms are likely to be explained under the clinical entity *sutika*, the aetiology of which is still obscure. The problem is further complicated by the 'selective action' of this element. Not only does it select a particular tissue or organ of the body (tissues most used and fatigued being affected early), but it shows a preference to a particular individual of the family (those with lowered resistance). Out of several women of the household using the same vermilion, only one or two are readily affected, while the others may escape altogether. This is explained in terms of idiosyncrasy, susceptibility or lowered resistance of the individuals thus affected. Different persons under the same conditions of lead exposure may show well marked variation in imbibing lead and producing symptoms of poisoning and the resistance of the same individual may also vary at different times (Monier-Williams, *loc. cit.*). A latent or dormant case of poisoning with an apparently good health record may become a pronounced case after starvation, medication, shock, acute infections, disturbance of calcium metabolism, changes in diet, etc. (Lynch *et al.*, 1934). The above conditions bring about 'mobilization' of lead from the bones which form 'lead depots' in our system and possibly from the reticulo-endothelial system which is known to retain a large quantity of lead. The mobilization is also effected during treatment of plumbism by certain de-leading agents, such as potassium iodide and sodium bicarbonate, which produce soluble salts of lead from insoluble lead phosphate in which form it is locked up in the bones. One should, therefore, be careful in prescribing these drugs in cases of lead poisoning.

Chemical examination of urine and faeces for determination of their lead-content is an important aid to detection of abnormal absorption of lead, and possibly to diagnosis of lead



poisoning. The latest methods of analysis give accurate figures of lead in all biological materials, and normal lead-content of human tissues and excretions have thus been carefully worked out (*vide* tables IV and V). These results have upset many of our preconceived

TABLE IV

Lead in normal urine and faeces : mg. of Pb per kilo (Bagchi and Ganguly, 1937).

	URINE		FÆCES	
	Minimum	Maximum	Minimum	Maximum
Hindus ..	Nil	0.016	0.08	0.14
Mohammedans ..	Nil	0.026	0.10	0.16
Anglo-Indians ..	0.024	0.040	0.13	0.18

TABLE V

Comparative statement showing the lead-content of tissues of healthy persons not exposed to lead and also of those exposed to abnormal lead risks, mg. of lead per kilo (Bagchi et al., 1939).

	Persons not exposed to lead. Death due to stabbing, shooting, etc. Only the maximum figures given here	A Hindu female with abnormal lead exposure. Death due to extensive burns	A Hindu male with abnormal lead exposure. Death due to fracture of skull.
Liver ..	0.82	0.98	3.6
Kidney ..	0.71	4.00	3.9
Lungs ..	0.60	0.60	1.09
Spleen ..	0.52	0.72	1.87
Stomach ..	0.60	2.20	1.10
Small intestine	0.60	1.50	0.90
Large intestine	0.68	1.87	1.20
Ovary ..	Nil	0.17	..
Uterus ..	0.47	0.60	..
Testes ..	0.40	..	1.2
Brain ..	0.10	0.90	0.75
Skin ..	0.50	..	0.75

ideas of lead poisoning and of lead in the tissues and excretions. Nowadays, the mere detection of lead in the urine, which was considered sufficient for purposes of diagnosis only a few years ago, is not regarded as of any diagnostic value. Any excess of lead over the normal limit either in the urine or in faeces indicates high absorption from abnormal exposure to lead and high absorption may or may not mean lead poisoning—the clinical picture and a sound clinical judgment of the physician being the determining factors.

The amount of lead present in the urine is not always a reliable guide to form a definite

opinion. It shows wide variability and sometimes appears to be misleading. In some cases, it is persistently low (within the normal range), although the faecal lead gives definitely high figures. The urinary lead excretion does not increase proportionally with increased lead exposure beyond a certain point (Kehoe *et al.*, 1933) and this point, the threshold value, so to say, appears to vary widely in different individuals. The faecal lead excretion is, on the other hand, an important guide for determining the lead absorption. It has been experimentally proved by several workers that a considerable portion of the lead in the system is eliminated through the faeces and only a small fraction is left for the kidneys to eliminate through the urine. The faeces contains (1) unabsorbed lead normally present in food, (2) unabsorbed extraneous lead ingested with food, (3) lead absorbed from the alimentary tract and excreted again into this tract for elimination, and (4) lead introduced into the general circulation through routes other than the gastrointestinal and mostly excreted by way of the liver and bile. It is therefore evident that the faecal lead indicates the actual state of lead exposure and absorption (*vide* table III). The chemical examination of blood does not help in any way in cases of insidious type of poisoning. The lead figure is always low (within the normal range) in these cases.

Lead workers always imbibe a large quantity of lead and consequently excrete, especially through the faeces, much higher amounts than what we find in the excreta of men with ordinary lead exposure. But only a few of these workers develop poisoning and the rest enjoy an apparently good health, although both these groups show high lead absorption. Case 1 in group II (table III) gave higher lead figures in her urine and faeces, but she had no complaints whatever, while the cases 2 and 3, having much less lead in their excreta, gave indications of lead intoxication. If a woman with excess of lead in her excretions, as for instance case 1, falls a victim to dyspepsia, due to causes not related to lead, or if she acquires a colic due to gall-stones, urinary calculi, appendicitis or gastric ulcer, or if she develops anaemia with weakness, lethargy and loss of weight due to commencing tuberculosis, the diagnosis becomes exceedingly difficult. The laboratory findings only remind the physician of the possibility of lead poisoning and do not help him otherwise. The physician at the same time must not forget that 'one can have fleas and lice together'.

#### *Sale of vermilion is a public health question*

The manufacture and sale of vermilion may be considered as an important public health problem and perhaps more important than the sale of adulterated food or drugs. There is no doubt that Hindu women and children, especially in Bengal, are exposed to an abnormal lead risk

which is peculiar in so far as it is neither accidental nor occupational. The subtle action of lead producing anomalous symptoms escapes the notice of the physician and it is difficult to establish the diagnosis of the insidious type of poisoning in this country. It is obviously a danger from an entirely unexpected quarter and as it is associated with time-honoured custom which is almost a religious institution with Hindu women, it is not possible to interfere with the use of vermilion in any way. The difficulty of stopping the manufacture and sale of adulterated vermilion can only be overcome if the State comes to the rescue. The health of the middle-class people is far from satisfactory and it is rare to find, in these days, women and children who are free from the so-called 'liver and dyspeptic troubles'. As lead is one of the causes of such troubles the problem of supplying genuine vermilion (free from lead) deserves careful consideration of Government and the public alike and necessary steps should be taken to stop the sale of adulterated vermilion.

#### Summary

Lead poisoning of industrial or occupational origin is unknown among women in this country. Men employed in printing presses, type-foundries, etc., frequently suffer from lead poisoning.

In connection with investigations on the lead-content of normal human tissues, excreta and hair, it was discovered that hair of Hindu women is very rich in lead. The source of lead was traced to cheap vermilion which contains red lead mixed with a red synthetic dye. That lead is absorbed through the scalp where it is applied, is indicated by high lead figures of the urine and faeces of these women.

The slow and steady absorption of lead extending over a long period may produce either the classical type or the insidious type of lead poisoning. Among Hindu women the classical type of poisoning is unknown. It has been suggested in this paper that some common ailments, such as anaemia, menstrual troubles, frequent abortions, dyspepsia, nervous troubles, high blood pressure, weariness of brain and body, etc., which are frequently met with among Hindu women, especially in Bengal, may be due to the insidious type of lead poisoning. Frequent abortions and sterility in women may, in the absence of other causes, be due to lead.

The diagnosis of such cases of lead poisoning is exceedingly difficult. The chemical examination of the urine and faeces is useful as an aid to diagnosis, but these findings as well as the objective symptoms, such as punctate basophilia (which is seldom found in Indian blood) and blue line on the gums, indicate only lead absorption and not necessarily lead poisoning. Lead absorption and lead poisoning should be clearly differentiated. In the insidious type of

(Continued at foot of next column)

## CHEMOTHERAPY IN PLAGUE

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WHILE the experiments described by Sokhey and Dikshit (1940) on the action of sulphathiazole in experimental plague infection in mice were being carried out at the Haffkine Institute, a research unit from the Institute was conducting at Bettiah, Bihar, a field trial on the therapeutic value of the Haffkine Institute anti-plague serum. Advantage was taken of this circumstance to test the therapeutic action of sulphapyridine (M.&B. 693) and sulphathiazole

(Continued from previous column)

poisoning, the lead-content of blood is within the normal range.

For differential diagnosis, the greatest difficulties may be given by those women suffering from gall-stone or urinary colic, appendicular troubles, early tuberculosis, or dyspepsia due to errors in diet, and at the same time giving high lead figures in their urine and faeces due to red lead being absorbed through the scalp.

Legislation to prevent the adulteration of vermilion with red lead has been suggested.

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in human plague infection also. Because of our unfamiliarity with these new drugs in the treatment of plague, we worked with a comparatively small dosage. In spite of this handicap the trial has yielded very important indications for the treatment of plague and we give the results in this paper.

#### *Material and methods*

At Bettiah, Bihar, plague broke out in epidemic form at about the end of last year. Bettiah Raj erected a temporary hospital with 30 beds for the treatment of plague cases and a medical unit was sent out from the Haffkine Institute to undertake the treatment. The unit commenced work early in January 1940 and was there till the first week of May. During this period, 294 cases in all were admitted for treatment. No selection of cases was made but patients as they were admitted were taken up in rotation for different forms of treatment. Thus, the first patient to be admitted received antiplague serum, the second admission received the usual hospital treatment, i.e., iodine solution intravenously and served as a control, the third admission received sulphapyridine, fourth again received antiplague serum, the fifth iodine control, sixth sulphapyridine and so on until admission no. 207. Thereafter, sulphapyridine was replaced by sulphathiazole. Later, it was decided to treat a larger number of patients with sulphathiazole. With this object in view treatment with serum was stopped and from admission no. 246, each alternate admission was treated with sulphathiazole, the other admissions serving as controls. From admission no. 262 two consecutive admissions received treatment with sulphathiazole and the third admission was used as control and treated with iodine.

On admission every patient was carefully examined for a bubo and other clinical signs of plague; 0.5 c.cm. of his blood was drawn from a vein and was spread in two equal portions on two agar slopes, in order to detect the presence of septicæmia and its degree if present. Immediately after this the patient was put on the specific treatment. Later, if the blood culture proved to be negative, the bubo was punctured with a needle and sucked-up material put up for culture. Out of 294 admissions, 19 proved not to be cases of plague. In addition to these 19 cases the following other cases require to be excluded. Six patients received combined treatment with serum and sulphapyridine—the number of cases so treated was too small to throw any light on the combined treatment; 4 patients left hospital before treatment was completed; 11 patients who were moribund at the time of admission died soon after (within 12 hours); 11 patients for whom blood cultures were not done for one reason or another could not be classified; and 6 patients proved to be cases of primary pneumonic plague; these are discussed below separately. Thus, it left 237 cases of bubonic plague which are accounted for in tables I and II.

#### *Treatment*

*Antiplague serum (Haffkine Institute).*—Forty c.cm. of the serum was given on the day of admission—20 c.cm. intravenously immediately on admission and 20 c.cm. subcutaneously 6 hours later. The same quantity of serum was given the next day in a like manner. Subsequent dosage and duration of treatment depended on the severity of the case. Mild cases did not require any serum after the first 2 days, while for severe cases it was administered usually for 5 days. The following precautions were taken for the intravenous administration of the serum :—

(1) The serum was warmed to body temperature and diluted with double the quantity of similarly warmed 25 per cent glucose saline.

(2) The serum-glucose-saline mixture was given slowly so that the 20 c.cm. of serum took at least 20 minutes to administer.

(3) 0.5 c.cm. of adrenalin chloride solution (1 : 1,000) and 1/100th grain of atropin sulphate were injected subcutaneously as a routine just before the first intravenous injection. During subsequent intravenous injections they were given only when required to treat the serum-shock.

In spite of these precautions, approximately 15 per cent of the cases treated with serum developed serum-shock either during the first or subsequent injections. These shocks, though sometimes alarming, were amenable to adrenalin and did not adversely affect the final result.

*Sulphapyridine.*—Two tablets (each 0.5 g.) were given on admission and one tablet every 4 hours thereafter for a maximum period of 7 days. The administration of the drug was however stopped earlier if the temperature of the patient came to normal and there was a distinct improvement in his general condition. To comatose patients the drug was given intramuscularly or intravenously and for this purpose the soluble salt was used, the dosage employed being the same as in the oral route. The same mode of administration was adopted when oral administration of the drug produced persistent vomiting. Such cases requiring parenteral administration of the drug were however rare. Another toxic symptom noted was that 4 out of 58 cases treated developed a spasmodic abdominal pain around the umbilicus after about 12 g. of the drug had been given. One case developed a combined urticarial and erythematous rash on the trunk and the extremities after receiving 4 g. of the drug. This rash disappeared of itself later.

*Sulphathiazole.*—This drug was given in the same dosage as sulphapyridine. The soluble sodium salt was given intramuscularly when the drug could not be given by the mouth. In general the same toxic symptoms were observed as with sulphapyridine, except they were on the whole of a milder character.

*Iodine.*—The controls received the usual hospital treatment in vogue for cases of plague in

India, *i.e.*, iodine solution intravenously. For this purpose a stock solution containing 5.5 g. of iodine and 8.5 g. of potassium iodide in 100 c.cm. of distilled water was prepared. 0.5 c.cm. of this solution diluted with 10 c.cm. of distilled water was given intravenously. The same dose was repeated every day for 5 days. The treatment was stopped earlier if the temperature came down to normal and the general condition improved.

### Results

We have presented the results in the following two tables. Table I incorporates the results of treatment in all the 237 cases with bacteriologically confirmed diagnosis of plague without making any differentiation into septicæmic or non-septicæmic cases. Presence or absence of septicæmia at the commencement of treatment

TABLE I  
All cases of bubonic plague treated

Treatment	Number of cases	Number of deaths	Case mortality, per cent
Antiplague serum ..	70	20	28.5
Sulphapyridine (M.&B. 693) ..	53	13	24.5
Sulphathiazole ..	32	5	15.6
Controls—treated with iodine solution intravenously.	82	43	52.4
TOTAL ..	237	81	..

is however a very important factor, and, in our opinion, the chief factor which decides the issue. In our experience, if the infection remained localized in the lymph glands spontaneous recoveries invariably occurred, but, if the organisms broke through the lymphatic barrier and invaded the blood stream, death invariably resulted. As we had examined the blood of 237 patients immediately on admission we were in a position to know whether they had septicæmia at the commencement of treatment and the results of treatment in such septicæmic cases are given in table II.

TABLE II  
Cases with plague septicæmia at the commencement of treatment

Treatment	Number of cases	Number of deaths	Case mortality, per cent
Antiplague serum ..	33	20	60.6
Sulphapyridine (M.&B. 693) ..	30	13	43.3
Sulphathiazole ..	12	5	41.8
Controls—treated with iodine solution intravenously.	40	38	95.0
TOTAL ..	115	76	..

### Cases of pneumonic plague

During the course of this field investigation 6 patients suffering from primary pneumonic plague were admitted to the hospital. They all came from the same household, 4 were admitted on one day and the other 2 the next day. Two patients were treated with iodine solution given intravenously and served as controls; the other 4 received sulphathiazole. It is almost certain that patients were brought to the hospital soon after the onset of the disease. On admission, sputum of all the patients showed very large numbers of plague bacilli and cultures of blood all proved sterile. In the case of the 2 control cases, *i.e.*, treated with iodine, plague bacilli appeared in blood about 24 hours after admission and both patients died on the third day. Duration of life after admission was less than 3 days. The 4 cases treated with sulphathiazole received approximately 4 g. of the drug daily. Two patients died on the third day, third patient on the fourth day and the fourth patient on the 11th day after admission. The characteristic feature of the cases treated with sulphathiazole was that daily cultures from the blood remained sterile in all cases, even in the case of the patient who lived for 11 days. No buboes developed in any of these patients at any time. In our numerous field investigations this is the first time we have come across cases of pneumonic plague. We shall discuss this more fully elsewhere. In these cases also we feel we did not give enough of the drug.

### Discussion

Table I shows that in all cases of plague taken together, *i.e.*, including both septicæmic and non-septicæmic, nearly 50 per cent died of the infection when treated with iodine. We have taken these cases as controls and propose to judge the effect of chemotherapy against these controls. It must, however, be remembered that iodine is claimed to have at least some curative action in plague, and, therefore, if the control cases had received only a symptomatic treatment and no iodine, the curative value of the serum and the two drugs would perhaps have appeared still better. However, as will be seen from the table all the three curative agents employed, *viz.*, the serum, sulphapyridine, and sulphathiazole produced a significant reduction in the case mortality, the percentage of deaths being 28, 24 and 15, respectively. The different percentage mortality rates obtained with the different forms of treatment is probably due to the unequal number of cases treated.

Statistically there does not appear to be any significant difference between the results of the three treatments. It may also be stated here that the unclassified and moribund cases left out of consideration, as noted above, were so evenly distributed that even if they are included they make no significant difference in the results.

The curative value of these chemotherapeutic agents under very severe conditions is however seen from table II, which records results obtained in septicæmic cases. Plague septi-cæmia is a very serious condition indeed, as the control cases, of which nearly 95 per cent died, show. In septicæmic cases treated with sulphathiazole and sulphapyridine, however, the case mortality was reduced to about 40 per cent, i.e., more than half of the cases treated recovered. Similar but slightly inferior results were obtained with the antiplague serum. This difference again may be due to unequal number of cases treated. Statistically no significant difference is apparent.

As regards the serum, we experienced serious difficulties in its administration. We wanted to give large dose but intravenous administration of even 20 c.cm. of the serum produced alarming symptoms in quite a number of cases. In our experiments with antiplague serum, it was found necessary to inject 0.4 c.cm. of the serum for a mouse of 25 g. weight. By analogy the equivalent dose for man weighing about 120 lb. would theoretically be in the neighbourhood of one litre and, even after allowing for the marked difference in the susceptibility to plague infection for the two species, a much larger dose than 200 c.cm., the maximum we used, would be needed.

It is now well recognized that, in the treatment with the sulphanilamides, it is the effective level of blood concentration of the drugs that decides the therapeutic result. This effective level varies with the nature of the infection, the degree of infection, and the animal to be treated. The defence mechanisms of the body are better developed in some animals than in others and it is generally conceded that these defence mechanisms co-operate with the chemotherapeutic agents in finally overcoming the infection. In the treatment of experimental plague infection in mice reported by Sokhey and Dikshit (*loc. cit.*), the best results were achieved with a concentration of free sulphathiazole in blood varying between 20 mg. and 10 mg. per 100 c.cm. (unreported figures). This concentration was maintained with an oral dose of 20 mg. given twice a day for 10 days for mice with an average weight of 25 g. In the case of the treatment of human cases reported in this paper, no effort was made to determine the level of the drug in blood reached, because we lacked the necessary facilities. But there is reason to believe that with the dosage of sulphathiazole and sulphapyridine used (about 3 g. a day), a concentration in blood of about 2 to 3 mg. per cent of the drug only could have been reached. Plague infection is much severer in mice than in men; 100 per cent of the mice infected with our standard infective dose die, while human case mortality in various epidemics varies between 50 and 80 per cent. In spite of this difference, a concentration higher than 2 to 3 mg.

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## A NOTE ON DRIED BLOOD PLASMA AND ITS PREPARATION IN INDIA

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THE difficulties associated with blood transfusions in this country are many, the chief being that associated with the production of a donor of the correct group at the requisite time. Blood banks may overcome certain difficulties, but are wasteful in that stored blood occupies a large

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per cent is clearly indicated and we believe that with higher concentrations, results much superior to those obtained in the present series will be achieved. We propose to try this out in the field trials under way at present.

### Summary

1. A report of treatment of 237 cases of plague with the Haffkine Institute antiplague serum, sulphapyridine and sulphathiazole in an epidemic at Bettiah is given.

2. In all cases taken together without differentiation into septicæmic or non-septicæmic cases, the case mortality in the serum, sulphapyridine, and sulphathiazole treatment was 28 per cent, 24 per cent and 15 per cent, respectively, as against 52 per cent in the controls. These reductions in case mortality are statistically significant, but not so the differences in the results of these different treatments.

3. Even in those severe cases in which septi-cæmia was present at the commencement of treatment all the three forms of treatment reduced the case mortality from 95 per cent in the controls to about 50 per cent in treated cases.

4. Six cases of primary pneumonic plague are reported.

5. The question of dosage employed has been discussed and it is suggested that a larger dose especially of the sulphanilamides used would reduce the case mortality still further.

Our thanks are due to Messrs. May and Baker for putting a liberal supply of sulphapyridine (M.&B. 693) at our disposal. Sulphathiazole was prepared in the Haffkine Institute and the powder was made into tablets by Cipla Laboratories, Bombay, to whom also our thanks are due.

### REFERENCE

Sokhey, S. S., and Dikshit, B. B. (1940). *Lancet*, i, 1040.

amount of refrigerator space and only keeps for 30 days. They are only practicable in large towns. Recent work on the use of blood plasma (and serum) has altered the entire outlook of the treatment of shock and hæmorrhage.

Cannon, Fraser and Hooper (1919) showed that in shock there was a diminished blood volume and hæmo-concentration. Blalock (1931) pointed out that in experimental burns there was a loss of whole plasma from the circulation. Walther (1937) confirmed this and pointed out that the rational treatment was to supply plasma to the denuded circulation. It is clear that shock is associated with the loss of plasma from the capillaries producing a concentration of blood cells.

Walther's contention has been proved by all recent workers and the present method of election in the treatment of shock is by transfusion with plasma (or serum), the essential constituents being the blood proteins.

Best and Solandt (1940) have shown that both plasma and serum are equally efficacious. In hæmorrhage the obvious method of treatment is to replace the blood lost by blood of a suitable type and until recently this has been the method in use. Recent work however has emphasized the value of plasma and serum. In practice, hæmorrhage without shock is extremely rare. Edwards, Kay and Davie (1940) point out that it is very rare for a patient to lose more than three pints of blood in a severe hæmorrhage, as the resulting lowering of blood pressure causes cessation of the bleeding. In such cases, a patient is left with 75 per cent of the erythrocytes in some part of the circulation. Providing therefore that the blood pressure can be raised and maintained by the introduction of a fluid of a suitable osmotic pressure into the circulation, a three-pint loss of blood can be treated and favourable results expected. Plasma or serum provide such a fluid.

As hæmorrhage rarely occurs without shock and the accurate separation and estimation of either of these conditions are extremely difficult, it is more than probable that the cause of death in hæmorrhage cases is due to a combination of blood loss *plus* shock. One factor common to both is loss of blood proteins contained in the plasma. The obvious method of treatment is to restore and maintain the circulatory volume by the administration of the proteins. This can be done by transfusing with plasma or serum.

In earlier work, liquid plasma or serum were used and has the advantage that a certain amount could be given without reference to blood grouping. They were stable at room temperature. Blood plasma and serum can be solidified and in the west have been kept at room temperatures for 12 months without

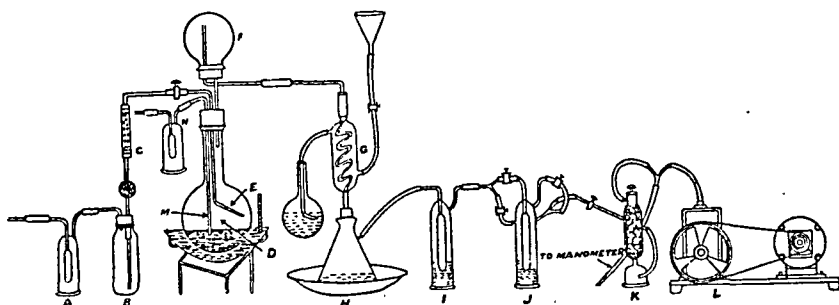
deterioration and with a considerable saving of storage space.

It appears that in solid plasma and serum we have substances for the treatment of shock and the majority of hæmorrhage cases possessing none of the disadvantage of whole blood transfusion and which should be of the greatest value in this country in that a valuable method of treatment is made easily available for outlying towns. Its use in the field during war is obvious.

The requirements for a transfusion are 20 grammes solid plasma dissolved in 250 c.cm. distilled water which is the equivalent of the plasma-protein value of one pint of citrated blood. Up to 500 c.cm. can be given regardless of blood grouping. Twenty grammes plasma fills an ordinary-sized test-tube.

### Method of preparation

For converting liquid plasma into a crystalline solid, we have modified the procedure of Edwards, Kay and Davie (*loc. cit.*) and have employed an apparatus whose sketch is here reproduced:—



**A** is a bubbler containing 0.1 per cent mercuric chloride solution to sterilize the incoming air.

**B** is the liquid plasma bottle. This bottle has a screw top and a metallic screw cap with two small holes and with a rubber diaphragm through which liquid plasma can be introduced by means of a needle.

**C** is an arrangement of a bulb containing sterile gauze and a tower containing glass beads or short bits of thin glass tube for filtering the plasma.

**D** is the actual drying flask into which the plasma is introduced in the form of a strong thin jet or spray through the tube **E** which is drawn to a fine point.

**F** is a safety flask used to collect any froth which flows back into the flask **D**. The flask **D** is heated in a thermostat maintained at 37°C. The water vapours are condensed at **G** and collect in the receiver flask **H** which is surrounded with ice. By maintaining a flow of ice cold water through the condenser **G** and by keeping the receiver **H** also ice cold, the speed of distillation has been increased. The flask **H** is connected to the bubbler **I** containing 0.1 per cent mercuric chloride solution which eliminates all chances of infection if there is a back diffusion. The bubbler **I** is connected with the bubbler **J** in such a way that **J** can be put in or out of the circuit at will without interrupting the vacuum. A soda lime tower **R** is interposed between the whole apparatus and the vacuum pump **L**. Before starting, the entire apparatus from **B** to **H** is sterilized with a dummy empty bottle at **B** which is then replaced by a fresh bottle containing the liquid plasma, and the distillation is started and continued till all the available plasma has been dried. The flask **D** is provided with another inlet tube **M** to

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## SEDIMENTATION RATE OF RED BLOOD CELLS IN EPIDEMIC DROPSY

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THE sedimentation rate of the red blood cells was determined of 74 epidemic dropsy patients and of 8 persons in whom symptoms resembling those of epidemic dropsy were produced after taking food cooked in mustard oil incriminated in natural outbreaks of the disease or in mustard

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drive off vapours whenever desired. M is provided with another mercuric chloride bubbler N.

After drying, the mass of solid plasma is removed aseptically and packed in convenient-sized tubes after grinding. Edwards *et al.* (*loc. cit.*) recommend that the dried plasma should be ground into a fine powder to facilitate solution in distilled water, or 5 per cent glucose solution. Our experience however is that it is best to grind it only to the stage when it will pass through a sieve, approximately no. 12. Contrary to the above authors we find that finely-powdered plasma takes much longer to dissolve than the coarsely-powdered one, on account of the difficulty of wetting with the former. Coarsely-powdered plasma dissolves rapidly and entirely. Often, however, there remains a very slight undissolved residue. This residue is probably denatured fibrin or some other protein and rarely amounts to more than 0.1 to 0.5 per cent of the total dry plasma. This minute residue can be filtered through a Seitz, Berkfeld or Chamberland type of filter.

All published work up to the present has been undertaken in a temperate climate and nothing as yet is known as to the effects of variable conditions found in the tropics on plasma and serum. We are undertaking investigations into these questions, and other biochemical and clinical aspects of dried plasma production, properties and therapy. Results will be published in due course.

### Acknowledgments

We wish to express our thanks to Doctors A. Sami and S. R. Dhall and Mr. A. A. Qureshi for their assistance.

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oil to which known quantities of argemone oil had been added (Chopra *et al.*, 1939). The cell volume and the hæmoglobin percentage were also estimated. The methods employed were:—

1. *Sedimentation rate.*—Westergren's (1926) method was used. The readings were taken every 10 minutes for 2 hours. The tests were carried out at room temperature which varied from 29°C. to 34°C. during the period of these examinations. Although from observations made on parallel tests carried out at different temperatures, there is an acceleration in the rate of sedimentation at higher temperatures, the actual difference within the range of room temperature 29°C. to 34°C. is not sufficiently great to alter materially the results obtained.

2. The cell volume was determined by noting the volume of packed cells after centrifugalization at 3,500 revolutions for half an hour. The anticoagulant used was a mixture of potassium oxalate and ammonium oxalate in proportions recommended by Wintrobe and Landsberg (1935). The tubes after the addition of the solution of anticoagulant were dried over calcium chloride under vacuum in a desiccator.

3. The hæmoglobin was estimated according to Newcomer's method using the Klett-Newcomer's glass standard equivalent to 0.038 per cent hæmoglobin solution. The 100 per cent hæmoglobin by this method is equivalent to 15.3 grammes hæmoglobin per 100 c.cm. of blood.

4. The corrections of the sedimentation rate were made according to Wintrobe and Landsberg's (1935) graph in which corrections are made for variations in the cell volume. The average cell volume was taken as 43 instead of 47 used by Wintrobe and Landsberg.

As a control the blood sedimentation rate was estimated of 22 apparently healthy adults of the labouring class between the ages of 25 to 40. Individuals belonging to the labouring class were selected as the epidemic dropsy cases examined were mostly of that class. The results are given in table I.

The cell volume in this series of apparently healthy individuals ranged from 36.0 to 49.8 with an average of 43.1 and the hæmoglobin between 13.4 to 18.1 grammes per 100 c.cm. of blood with an average of 15.3 grammes.

A summary of the results of the sedimentation rate, the cell volume and the hæmoglobin content of 74 patients suffering from epidemic dropsy is given in table II. At the time of examination the patients were suffering from active disease and the degree of œdema is taken as an index of the clinical condition.

The increase in sedimentation rate is most marked in patients during the acute stage of the disease and is less in patients with slight or no œdema. The decrease in hæmoglobin content is most marked during the acute stage of the disease. The cell volume is also decreased during the acute stage.



TABLE I

*Data calculated from estimations of the cell volume, the hæmoglobin, and the sedimentation rate of 22 apparently healthy individuals of the labouring class*

Serial number	Age	Cell volume, per cent	Hæmoglobin, grammes per 100 c.cm.	Sedimentation (mm.) after 1 hour (uncorrected)	Sedimentation (mm.) after 1 hour (corrected)
1	40	38.0	..	7	1
2	17	36.0	..	16	6
3	40	39.6	..	14	10
4	29	40.2	13.8	9	5
5	34	44.8	16.5	6	6
6	32	44.4	16.1	18	18
7	36	43.8	15.2	18	18
8	38	46.9	16.7	7	7
9	40	42.7	15.1	8	8
10	32	42.9	15.3	3	3
11	37	45.8	16.3	18	18
12	31	41.9	15.1	12	11
13	28	41.4	13.4	12	10
14	30	49.8	18.1	6	6
15	26	42.7	14.8	13	13
16	30	47.6	16.9	17	17
17	30	43.2	15.1	15	10
18	32	45.6	16.1	2	2
19	38	39.2	13.5	11	7
20	42	42.4	13.5	2	2
21	26	42.7	14.6	4	4
22	27	46.6	15.3	11	11
Average	32.5 ± 5.9	43.1 ± 3.2	15.3 ± 1.2	10.4 ± 5.2	8.8 ± 5.3

TABLE II

*The sedimentation rate, the cell volume and the hæmoglobin content of 74 patients suffering from epidemic dropsy*

Clinical	Number examined.	Sex	CELL VOLUME		Hæmoglobin, grammes per 100 c.cm.	SEDIMENTATION (MM.) AFTER 1 HOUR	
			Average	Limits		Average	Limits
Marked œdema ..	12	M. 2 F. 10	30.9	20.0-34.5	7.1	93.0	30-137
Moderate œdema ..	17	M. 9 F. 8	27.9	20.0-37.5	8.7	86.8	38-141
Slight œdema in the evening.	41	M. 28 F. 13	33.3	13.1-47.6	11.2	57.6	19-150
No œdema ..	4	M. 4 F. 0	38.1	30.0-50.0	12.8	38.5	18-51
Normal average ..	22	M. 22	43.1	36.0-49.8	15.3 ±	10.4	2-18

The results of examinations carried out in six patients during the acute stage of the disease and again when symptoms had subsided are given in table III.

The results show that with a cell volume above 35 and hæmoglobin above 12.6 gramme per 100 c.cm. or 82 per cent hæmoglobin œdema was not often present or when present was only slight. This is well seen in tables IV and V.

The blood sedimentation rates of eight individuals who ate food cooked in mustard oil containing approximately 5 per cent of argemone

oil and who subsequently developed symptoms resembling epidemic dropsy are given in table VI.

The first two cases had marked acceleration of sedimentation rate with low cell volume and low hæmoglobin. These two individuals were the worst sufferers. The third, fourth and fifth cases were not markedly ill when the blood was examined but became worse a few days later. The last three cases had transient œdema and recovered rapidly. These results illustrate the value in prognosis of the blood sedimentation

TABLE III

*The sedimentation rate (E S R), cell volume (C V) and hæmoglobin during the acute stage of the disease and when the acute symptoms had subsided*

Serial number	DURING ACUTE STAGE OF THE DISEASE WITH WELL MARKED OEDEMA			DURING CONVALESCENCE No OEDEMA			Interval between the first and second readings (days)
	ESR	CV	Hæmoglobin, grammes	ESR	CV	Hæmoglobin, grammes	
1	98	22.5	6.7	81	34.5	8.7	14
2	88	21.0	7.0	70	34.1	11.1	21
3	82	26.0	9.9	81	36.9	12.5	13
4	68	37.0	10.1	61	39.8	13.6	18
5	57	42.8	9.8	35	42.9	15.5	13
6	51	39.8	9.5	32	43.6	14.9	13

TABLE IV

*Cell volume and œdema in 62 cases of epidemic dropsy*

Cell volume	OEDEMA AND NUMBER OF PATIENTS		
	Marked	Moderate	Slight
16-20 ..	2	1	1
21-25 ..	4	3	4
26-30 ..	4	7	4
31-35 ..	2	3	10
36-40 ..	0	1	14
41-45 ..	0	0	1
46-50 ..	0	0	1

TABLE V

*Hæmoglobin and œdema in 65 cases of epidemic dropsy*

Hæmoglobin percentage	DEGREE OF OEDEMA AND NUMBER OF PATIENTS		
	Marked	Moderate	Slight
20-30 ..	1	0	2
31-40 ..	2	0	0
41-50 ..	5	5	5
51-60 ..	2	5	4
61-70 ..	0	4	11
71-80 ..	1	1	7
81-90 ..	0	0	8
91-100 ..	0	0	0
101-110 ..	0	0	1
111-120 ..	0	0	1

rate, a marked increase in sedimentation rate indicates a bad prognosis. There were however certain anomalous cases. A patient with moderate degree of œdema and who recovered rapidly had blood sedimentation rate of 150 mm. (uncorrected) in 1 hour and two patients with well-marked œdema and in whom recovery was slow had sedimentation rates of 30 and 32 mm. in 1 hour.

In view of the generally accepted opinion that fibrinogen plays a large part in determining the rate of sedimentation of human red blood cells, estimations were made of the sedimentation rate, the cell volume, the hæmoglobin and the fibrin-

TABLE VI

*The sedimentation rate, the cell volume and the hæmoglobin content of eight individuals who ate food cooked in mustard oil containing 5 per cent argemone oil and who subsequently developed symptoms resembling epidemic dropsy. The estimations were made within a week of the onset of symptoms*

Serial number	Sedimentation (mm.) after 1 hour	Cell volume	Hæmoglobin, grammes per cent
1	123	28.6	9.5
2	104	31.5	10.5
3	91	38.3	12.8
4	71	41.9	15.8
5	65	35.5	11.8
6	41	39.3	13.7
7	39	41.5	14.5
8	33	34.3	11.3

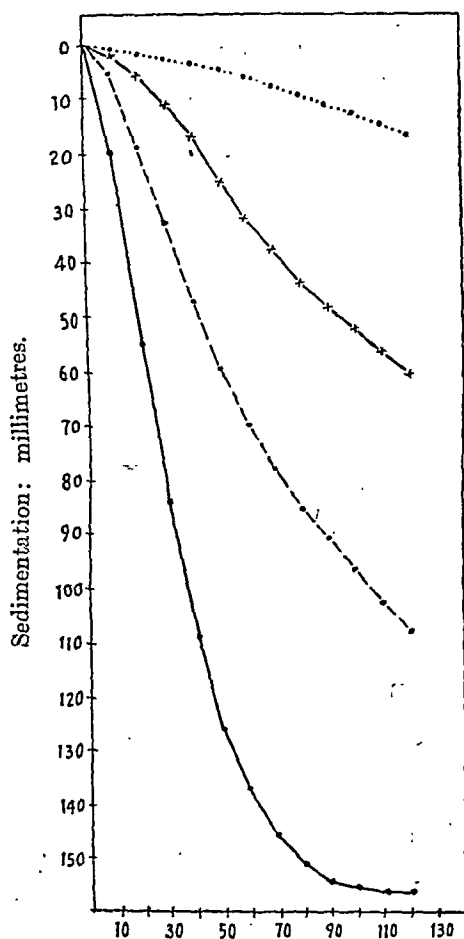
nitrogen content of 20 cases of epidemic dropsy. The results obtained suggest that the sedimentation rate, the fibrin content and the cell volume are interrelated. An increase of fibrin leads to an increase of sedimentation rate provided the cell volume is the same. An increase of cell volume decreases the sedimentation rate provided the fibrin content is constant.

The blood sedimentation rate was estimated every 10 minutes for 2 hours. In the graph are given representative results of the readings taken in (1) a healthy individual, (2) a convalescent case, (3) a case of epidemic dropsy of moderate severity and (4) a severe case of epidemic dropsy. The results, which are typical examples taken from a number of observations, show the increase in the sedimentation rate during the acute stage and the return towards normal during convalescence. The sedimentation rate serves as an index of the severity of the outbreak.

Recent work on the sedimentation rate of red blood cells has shown that this non-specific test is a valuable index in indicating disease processes where other tests often fail. An outbreak of epidemic dropsy in a closed community in which 242 boys had been exposed to the same

risk was studied recently. Nine boys who were in apparently good health and had no symptoms or signs suggestive of epidemic dropsy were found to have increased blood sedimentation rate. The average blood sedimentation in these nine boys was 55 mm. with limits of 19 to 122 mm. in one hour. There was a definite increase of sedimentation rate of the red blood cells thus

GRAPH



Time: minutes.

..... a healthy individual.

x—x a convalescent case.

o—o a case of epidemic dropsy of moderate severity.

●—● a severe case of epidemic dropsy.

suggesting that these boys were in a pre-epidemic dropsy state. The use of mustard oil for cooking purposes was stopped and the outbreak of epidemic dropsy came to an end and it was not possible to investigate this point further.

#### Summary

The sedimentation rate of red blood cells, the cell volume and the haemoglobin content were estimated in a series of 74 cases of the natural disease and in 8 persons in whom symptoms resembling those of epidemic dropsy were produced following the intake of mustard oil containing argemone oil.

(Continued at foot of next column)

## BIOLOGICAL CONTROL OF *CULICINE* MOSQUITOES, BY PRAWNS IN A BENGAL COAL MINE

By FRANK McCAY, M.A., M.D. (Cantab.),  
D.T.M. & H. (Lond.)

Chief Medical Officer

and

R. SENIOR WHITE, F.R.S. (Edin.)

Malariaologist, Bird and Co., and to the Bengal Nagpur Railway

In January 1939 *Culicine* mosquitoes were discovered breeding prolifically in the small shallow pools that had accumulated near the wet working 'face' in some of the galleries of a section of Saltore colliery. This mine is about 130 miles away from Calcutta and three miles to the west of the Grand Trunk road and lies for its greater part under the junction of the Damodar and Burrakur rivers where they form the north-western boundary of Bengal. The mosquitoes were probably sucked into the mine in the main air draught and then either flew or were blown along the galleries which here were about 1,000 feet underground. Conditions were ideal for breeding as the temperature remained constantly at about 90°F. and the humidity at 80 per cent all the year round; there was, moreover, a plentiful supply of human blood available

(Continued from previous column)

The sedimentation rate of red blood cells is increased in epidemic dropsy and this test is useful in excluding non-epidemic dropsy cases and in prognosis. There was not a single case of established epidemic dropsy in which the sedimentation rate was not increased. As a rule, the higher the rate, the severer the disease and the worse the prognosis.

In an outbreak of epidemic dropsy in a closed community evidence was obtained suggesting that the increase in sedimentation rate occurs even before the development of the clinical disease. This simple test which can be readily carried out in routine clinical examinations is capable of revealing tissue damage long before the development of symptoms. This test would be a valuable one in epidemiological studies.

Fibrin-nitrogen content was estimated in a series of 20 cases of epidemic dropsy. The results suggest that the sedimentation rate, the cell volume and the fibrin content are inter-related. An increase of fibrin leads to an increase in the sedimentation rate provided the cell volume is constant. An increase of cell volume decreases the sedimentation rate provided the fibrin content is constant.

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throughout the 24 hours as two shifts of 12 hours each were being worked daily. We cannot find any reference to mosquitoes being found living and thriving at this depth reported previously in the literature.

It was also noticed, however, that certain of the pools contained prawns as well as mosquito larvæ and pupæ and further that where the prawns were more numerous the mosquito larvæ and pupæ were fewer, while in other more recent pools the reverse was found to hold good. The prawns were quite small and had apparently got into the mine in the moist sand which was used for stowing.

As this seemed to be a new and important natural means of control it was decided to investigate the problem and specimens of both the prawns and the mosquito larvæ were brought down to Calcutta. Research was somewhat delayed for various reasons but in due course the prawns were identified by the Zoological Survey of India as *Palæmon lamarrei* Miln. Edw., which is a hardy fresh-water species found everywhere in the plains of India. The life history of *Palæmon lamarrei* has not yet been worked out, but if, as is usual, the eggs are attached to the mother until they hatch, the prawns themselves may enter the mine in the moist sand. If the eggs are laid free, they may be washed in with the sand in this form. We seem to remember an inquiry in a popular song some time ago as to whether prawns made good mothers and the answer certainly does seem to be in the affirmative, even if zoologists have not yet completed their research on the problem.

It was found that the prawns could, on an average, consume nearly three *Culex fatigans* larvæ each per day. This is a very poor rate of consumption compared with a larvivoracious fish of the *Gambusia* family, but on the other hand it is unlikely that these fish would flourish in darkness or in such shallow pools. In addition there would be the extra expense of having to introduce the fish into the mine if they were to be tried out as a means of control. It was found however that *Gambusia* fish—at any rate in the aquarium—could eat the prawns, although they were more of a mouthful than the mosquito larvæ on which they normally fed.

We both revisited Saltore when the laboratory work was completed and found that the prawns had apparently completely cleared that section of the mine where breeding had originally been noticed. Climatic conditions and the state of the pools had remained much the same and there were still plenty of miners about to provide a good supply of blood. Another section of the mine about two miles away where there had been a mosquito nuisance but where there were no prawns was also visited and a few adult species of *Culex fatigans* were seen. In this area, however, coal 'winning' was over and 'goafing' was in progress. This requires a much smaller labour force in the immediate

vicinity and involves the formation of a tremendous amount of dust when the pillars are removed and the roof actually falls. Thus most of the nearby pools were covered with fine coal dust which is probably effective as a larvicide. Another part of the mine is now being worked where mosquitoes but no prawns are present, and we have suggested introducing a few prawns into the pools in this area to see if it also can be cleared of mosquitoes. We have just had an *ad interim* report from the manager to the effect that neither the prawns nor mosquitoes are doing very well at the moment as the pools are constantly being disturbed by the work of the miners.

Sand stowing is now being enforced in more and more mines in both the upper and lower fields, and thus more evidence of this natural means of mosquito control should be observed in the—probably numerous—mines in which mosquitoes are breeding. We have so far not seen or heard of any *Anopheline* species breeding below ground, but there are plenty on the surface and there is also a considerable amount of human malaria present. We feel therefore that the more research and publicity the prawns get in their struggle for existence the better conditions will be for men working in the mines. The prawns may quite likely prove useful to a limited extent in the surface control of malaria even if infection with this scourge has not yet started to take place below ground. So far they do not appear to have been recognized as a possible means of larval control by malariologists.

At Saltore where mine water is now pumped up, filtered, and then chlorinated before it is used in the *dowrahs*, etc., numerous prawns were caught in the settling tanks and tended to clog the filters. We do not think however this should be counted against them as they are edible and can be served up in many palatable forms to both coolies and managers alike. It will surely be an added joy when eating prawn curry to know that the prawns have got fat in helping to fight our mutual enemy—the mosquito.

Our thanks are due to Messrs. Bird & Co., their Chief Mining Engineer and their manager at Saltore for all the facilities and help they have given us.

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## A Mirror of Hospital Practice

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### AN UNUSUAL COMPLICATION AFTER OPERATION FOR REMOVAL OF TONSILS AND ADENOIDS

By P. V. CHERIAN, M.B., B.S., D.L.O., F.R.F.P.S., F.R.C.S.E.  
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Government General Hospital, Madras

Case 1.—Female, aged 12 years, Anglo-Indian, was admitted into hospital in July 1930 for removal of tonsils and adenoids. The operation was done on the day of admission but the post-operative progress was

not satisfactory. The girl was running a slight temperature and there were white sloughs in both tonsillar fossae. An intramuscular injection of colossal silver (2 c.cm.) was given on the third day without any beneficial effect. The throat now appeared very septic with marked sloughing. A smear was taken and the bacteriologist gave a positive result for diphtheria from smear and culture. The patient died the next day in spite of usual treatment for diphtheria. On enquiry from the parents it was found that a younger brother of the patient was suffering from diphtheria.

Case 2.—A male, Indian, aged 7 years, was operated upon for enlarged tonsils and adenoids on 10th January, 1939, and was discharged the same evening. Three days later the child was brought back with two white patches on both lips. These looked like diphtheritic membranes. Bacteriological examination confirmed the diagnosis. The child made an uneventful recovery under serum treatment. There was no history of any exposure to infection in this case.

Diphtheria used to be a rare disease in India especially among the Indians. Most of the cases were among European and Anglo-Indian children. But towards the latter half of 1936 there was almost an epidemic in Madras affecting both the European and Indian population. Since then we regularly see a number of cases among Indians, mostly among school-going children.

The two cases reported above are the only instances of this complication during the last 12 years in nearly twenty-thousand operations for removal of tonsils and adenoids. If the presence of a case of diphtheria at home in the first case had been brought to my notice no operation would have been done at that time. But the second case is entirely different.

I have not read about this complication in any textbook or journals and so I am reporting these cases as of interest.

### A CASE OF DACRYOPS

By RAM PRASAD TREHAN, L.S.M.F., P.S.M.S. (U. P.)

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Banda District, U. P.

A GIRL, aged 3 years, was brought to this dispensary on 18th February, 1940, by her relatives for the treatment of:—

- (i) Epiphora from the right eye for last 6 months.
- (ii) A swelling in the upper part of the right eye which was increasing in size gradually for the last 6 months.

The left eye on examination was found to be perfectly normal.

On examination of the right eye I found that (i) Interpalpebral aperture was narrowed. The upper lid of the right eye was on a lower level than that of the left eye. (ii) Marked epiphora from the eye was present. (iii) Lachrymal passages were quite normal. (iv) Bulbar conjunctiva was quite normal. (v) In the upper fornix a whitish swelling of the size of three-quarter of an inch by half an inch was seen. This swelling became much more marked on everting the upper lid when it was seen extending on the inner aspect of the upper lid to about one-quarter of an inch above the lid margin and above the limbus. This swelling was cystic in feeling. (vi) Rest of the eye was quite normal.

The only such swellings in the eye in the upper fornix could either be dacryops, which is the name given to the cystic swelling in the upper fornix due to retention of secretion owing to blockage of one of the lachrymal ducts or a retention cyst of the Krause's gland.

The position of swelling is only the differentiating point between the two.

The case having been diagnosed as a dacryops, the patient was operated upon on 18th February.

After thoroughly cocainizing the eye and irrigating it with boric lotion the cyst was incised by a cataract knife, when about 1 c.cm. of crystal-colour fluid, just like tears, came out and with the escape of this fluid the swelling completely disappeared.

The patient was kept under observation for one day more. The patient had no more epiphora and was discharged next day with instructions to come back if the swelling reappears. The patient has not come back so far.

The point of interest in this case lies in the rarity of this condition.

I am much indebted to Dr. K. S. Dikshit, P.M.S., Civil Surgeon, Banda, for allowing me to publish this case.

### RECOVERY OF *SPIRILLUM MINUS* FROM THE PERIPHERAL BLOOD OF A RAT-BITE FEVER CASE BY EXPERIMENTAL INOCULATION INTO A CLEAN MOUSE

By R. ROW, M.D. (Lond.), D.Sc. (Lond.)

S. D. AMBEGAONKER, M.B., B.S., M.R.C.P. (Lond.)  
and

Y. M. BHENDE, M.B., B.S.

(From the Pathology Department, P. G. Singhanee Hospital, Bombay)

L. G., aged 10 years, was admitted into the P. G. Singhanee Hospital for fever with occasional exacerbations (duration 20 days), on 14th August, 1940. He gave a history of a rat bite on the left great toe about five weeks before admission. The wound caused by the rat bite soon healed with some household remedies, leaving a scar. He started getting fever after being well for about 17 days. He was free from any skin lesions for which a close watch had been kept, nor were any joint pains complained of. The following temperature record shows the nature of the fever after his admission into the hospital:—

Date	6 a.m.	10 a.m.	6 p.m.	10 p.m.
14-10-40	..	..	102.5	101.5
15-10-40	97	98	98.0	101.0
16-10-40	97	97	98.0	101.5
17-10-40	97	97	97.0	97.0
18-10-40	97	97	98.0	100.5
19-10-40	97	97	99.5	101.0
20-10-40	100	98	99.0	99.0
21-10-40	99	99	100.0	101.0
22-10-40	98	98	99.5	100.0
23-10-40	99	98	98.0	100.0
24-10-40	99	99	99.0	101.0
25-10-40	97	98	98.0	98.0

The blood showed no malarial parasites nor any spirilla and the blood picture was as follows:—

Red corpuscles	..	3,420,000 per c.mm.
Leucocytes	..	10,500 " "
Hæmoglobin	..	55 per cent.
Polymorphonuclears	..	70 " "
Lymphocytes	..	27 " "
Monocytes	..	.. " "
Eosinophils	..	3 per cent.

Widal test was negative for *Bacillus typhosus*, *paratyphosus A* and *B*.

Urine showed a large amount of albumin, red corpuscles, pus cells and granular casts. No acid-fast organisms were found.

Sputum showed no acid-fast organisms.

X-ray report was 'no infiltration'.

It was felt desirable to examine his blood during the height of his fever, so as to ascertain if one could isolate

any spirilla by infecting a clean mouse. The patient's peripheral blood was examined under dark-ground illumination on 14th August, 1940, with negative results. A part of the centrifuged deposit of one c.cm. of this blood in citrated saline was injected intraperitoneally into a clean mouse. This animal showed heavy infection of *Spirillum minus* in its peripheral blood on 26th August (12 days after inoculation), although when examined on the 8th day none were found.

One cannot say if the kidney lesion of this patient was caused by the spirochætal infection.

The recovery of *Spirillum minus* in this case is of interest in that with an experimental inoculation into a clean white mouse it is possible to demonstrate the presence of *Spirillum minus* in the peripheral blood of a patient with a clear history of rat bite, even in the absence of skin lesions and with no other manifestations than an irregular obscure fever with occasional exacerbation and therefore one may feel justified in recording this fact.

[Note.—Cases of this nature though uncommon are not unknown, and recovery of *S. minus* by inoculation of peripheral blood into mice is by no means an uncommon procedure. Also kidney irritation as a result of this infection is recognized to occur occasionally, especially in children.—EDITOR, I.M.G.]

## THROMBOPHLEBITIS OF THE CAVERNOUS SINUS

By RAI BAHADUR B. B. HAJRA, M.B.

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and

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THROMBOPHLEBITIS of the cavernous sinus is a condition where, with expectant treatment, practically all cases die from septicæmia, meningitis, etc. The numerous tributaries and effluents of this sinus render it a very common site of infection. Boils and infections of the 'dangerous area of the face', that is, the upper lip, septum of the nose, and the adjacent area, are by far the commonest cause of this dreaded lesion. The anterior facial vein which drains the dangerous area has no valves and any clots therein may easily be detached and transferred to the cavernous sinus as the result of the massage to which it is subjected by the movements of the facial muscles. Thrombosis of the sinus may however also occur by extension of inflammation through its wall. It is now becoming increasingly recognized that timely and judicious surgical intervention and heroic doses of sulphonamide can save many an otherwise hopeless case. Notes of a few illustrative cases are given below:—

Case 1.—A Mohammedan boy, aged 10, had a boil on the tip of his nose which he scratched eight days previously. Spreading swelling of the face, suffusion of the eyelids and protrusion of the left eye followed. On the eighth day he was seen to have swelling of the entire face, chemosis and œdema of the left upper lid and root of nose; proptosis of the left eye, complete ophthalmoplegia with high fever and toxæmia.

The following treatment was instituted:—

(1) Antistreptococcal serum 10 c.cm. daily—two such.

(2) Sulphanilamide tablets (Albert David, Ltd.)—two tablets four hourly—two such, one tablet six hourly—four such, one tablet eight hourly—three such, half tablet eight hourly—six such.

(3) Locally compress with lotio hydrarg. perchlor. 1 in 4,000. Lotio protargol 5 per cent dropped into left eye.

The patient responded marvellously and in 48 hours he was afebrile. On the sixth day of the commencement of this treatment he was given normal diet. Unfortunately the father of the child persistently refused to have the eye out which was sloughy and proptosed and took away the patient against medical advice.

Case 2.—A well-developed Hindu youth, aged 32, had a razor cut five days previously on the right cheek. This developed into an infected wound associated with high temperature and low delirium. The right half of the face became swollen with suffusion of the right eyelids. On the seventh day his temperature rose up to 104°F. The next day the right eye was proptosed and he was having swinging temperature with rigor. Unfortunately sulphanilamide was not given except at this stage. It was diagnosed as cavernous sinus thrombosis and the eyeball was enucleated in spite of its not being blind. The ophthalmic vein was found to contain purulent clots and the superior orbital fissure was enlarged and a drain was put in the cavernous sinus. The first part of Eagleton's operation in such cases, viz, ligature of the common carotid artery did not appear to be very sound being rather too severe for so ill a patient. After a prolonged convalescence the patient recovered.

Case 3.—A Mohammedan woman, aged 20, had a boil on the cheek below the right ear with œdema around. At first she was not very toxic. On the sixth day her condition became worse, temperature rose up to 103°F. with œdema spreading towards the inner canthus of the right eye and the eyelids were suffused. The cavernous sinus being in immediate danger the right angular vein was ligatured under local anæsthesia by novocain 1 per cent and sulphanilamide administered in heroic doses. Lotio hydrarg. perchlor. compress was given locally. Rapid improvement followed and the patient was discharged a fortnight later.

Case 4.—A man, aged 35, was admitted with swelling and œdema of the entire face and scalp, proptosis of the right eyeball, suffusion of left eyelids, temperature ranging between 100 and 104°F., and mild delirium. The left angular vein was tied and antistreptococcal serum was administered in heavy doses. Besides local treatment, stimulants and glucose were given as usual. Sulphanilamide was not given in this case. The patient expired on the eleventh day of disease. Operative interference could not be done on account of the party refusing it and sulphanilamide was not administered because it was not then available in an injectable form.

Infection of the face has a sinister reputation and the complication which heralds the fatal issue is thrombosis of the cavernous sinus; sulphanilamide therapy, as in many other dreadful diseases, has a notable place in the treatment of thrombophlebitis of the cavernous sinus. It has been seen that the combination of serum and sulphanilamide is certainly better than serum alone and probably also better than sulphanilamide given alone. A simple and small operation like ligature of the angular vein, if performed in time, may save a life. Eagleton's combined operation of ligature of the common carotid and enucleation of the eyeball is not, in our opinion, very sound and is apparently too severe for so ill a patient. Combined with sulphanilamide enucleation with draining of the cavernous sinus, if necessary, is certainly less drastic and more efficacious.

# Indian Medical Gazette

JANUARY

## THE FUTURE OF MEDICAL ORGANIZATION IN INDIA

EARLY last year we emphasized the need for better co-operation amongst the medical services in India; the occasion was an address by Lieut.-General G. G. Jolly, the director-general of the Indian Medical Service, to the Delhi Maternal Services Co-ordination Committee, in which he pointed out that maternity and child welfare constituted one of the fields in which the preventive and the relief medical services might clash and their work overlap, or in which they might make contact later leading to a fusion that would spread to other medical fields, until all their activities were as completely co-ordinated as their aim, the alleviation of human suffering by the banishment of disease, was unified. We attempted to trace how the rational, though slow, steps in the medical organization in this country, through their failure to keep up with a changing environment, had led to an irrational state of affairs, and we concluded with these words:— We believe that the time has passed when this artificial division [i.e., of the preventive and relief medical services] can serve any useful purpose, and that the next move must be the unification of the direction of the civil medical services. We do not suggest that the reform is an urgent one; on the contrary, we do not believe that there are yet available sufficient men with the necessary wide experience from whom the directors of medical services in the provinces must be selected, for the sanitary outlook and sanitary experience will be essential qualifications. The present system has worked well for many years and with a spirit of willing co-operation between the heads of the respective departments in the different provinces, it will probably continue to do so, but eventually, as medical science has but one aim, unification of direction is inevitable.

In the present number we have given an extract from Sir Ram Nath Chopra's presidential address to the National Institute of Sciences of India; in this address he has suggested the establishment of a Federal Ministry of Health for India. This seems to us not only to be in tune with other changes that are taking place in the government of this country but to be logically the next step in the evolution of the medical organization in India; such a ministry would have executive authority only with reference to health subjects reserved for the central government by the Government of India Act of 1935, or by any future Act, and would be mainly an agency for co-ordinating and advising similar health

organizations in the various provinces. By this means, all medical and closely allied subjects, whether they were associated with prevention or relief, would come under one government department with a minister and a single executive head, who might well be called the *director-general of Indian medical services*.

In this Federal Ministry of Health there would of course have to be numerous sections, each with an expert adviser. The division of the work of the ministry that we visualize would be on the following lines:—

- Port Sanitation, Quarantine Service, and International Health, including liaison with foreign and international health organizations.
- Public Health, Environmental, including Sanitary Engineering: water supplies, drainage, and refuse disposal, housing and town planning, and health aspects (anti-malarial) of rivers, irrigation, railway, road and other engineering.
- Nutrition: food and drug administration, and drug addiction.
- Industrial Hygiene.
- Pilgrims.
- Public Health, Special, including Epidemic and Infectious Diseases.
- Malaria, Tuberculosis, Leprosy, and Venereal Diseases.
- Maternity and Child Welfare.
- School Medical Service.
- Public Health, Information and Propaganda.
- Medical Education—in close co-operation with the Indian Medical Council and the universities.
- Medical Relief, including Rural Medical Relief.
- Hospitals.
- Health Insurance.
- Medical Supplies, including cinchona and other indigenous supplies and manufacture.
- Prisons.
- Lunacy.
- Scientific Research.

In Great Britain the Ministry of Health covers much the same field, but the emphases in the two countries naturally differ; for example, in England, industrial hygiene is far more developed and is provided with a separate department, and rural medical relief is correspondingly a less difficult problem. Similarly, pilgrimages, the major epidemic diseases, and malaria are particularly Indian problems; nor does the British Ministry of Health have to concern itself with medical education to such an extent as would an Indian one.

As well as the Federal Ministry of Health at the centre, each province would have its own ministry of health with its own minister and chief medical officer—what he is to be called is a secondary, though not entirely unimportant, matter; the term 'surgeon-general' has the sanction of tradition but is misleading in both its components, for not necessarily, in fact quite improbably, will he be a surgeon, nor, as far as the future is concerned, will he always hold military rank. The provincial ministries will have their various sections corresponding more or less to those of the central organization. The senior medical officers, whatever they are called, must be men of wide experience in both preventive and curative medicine, as also should the heads of the various sections; the intermediate



members of the medical organization may have to be specialists—surgeons, physicians, gynaecologists and pediatricians, tuberculosis, leprosy and venereal disease experts, sanitary engineers, chemists and analysts, professors and teachers, alienists, and research workers, but the ultimate medical unit, the rural dispensary medical officer, may have to widen his scope and be responsible for both medical relief and environmental hygiene, the latter possibly with the help of a sanitary inspector, and he will also have to be the inspirer of welfare work amongst the lay community.

Sir Ram Nath, in his address referred to above, has suggested Federal and provincial organizations on very much the same lines as these; he has also emphasized the fact that the chief medical officers and the sectional heads will have to be men of wide experience, and he has suggested that during their probationerships, in order to widen their outlook, they should be given the opportunity to act as deputies in a number of different sections in the department—a small detail of administration but one that is of the utmost importance, for the success of the scheme will depend on a proper understanding between different sections of the department, as well as on the official liaison that will be effected through the common head of the department.

We are not suggesting that there should be any sudden and revolutionary change in the medical administration at the centre or in the provinces, for though, as Sir Ram Nath has pointed out, there is already in existence much material which could be adapted to the new

organization in the course of a few years, yet to provide the full complement of suitably trained men for the scheme, a considerable change in the outlook of those responsible for medical education will have to be effected.

The position with regard to public health training a few years ago was that the men who had taken their diplomas often found difficulty in obtaining suitable employment; this is to some extent being remedied and the importance of this training is being appreciated by local bodies responsible for appointments; but not yet to the extent that it should be. The medical organization that we have visualized would absorb a very much larger number of men than is at present available or would be likely to be turned out by our present public-health-teaching organization, so that this will have to be extended considerably. Beyond this there will have to be an extensive change in the medical students' curriculum and they must be imbued with the preventive outlook to a far greater extent than they are at present.

All these changes will have to precede the full establishment of the 'new order' in the medical organization of this country that we have outlined, so that this matter should be considered as very urgent. On the other hand, it is useless to turn out a large number of public-health-diploma holders if they are not going to find suitable work, and therefore the sooner the projected organization is clearly laid down and the Federal and provincial ministries of health are formed, even if at first on a skeleton basis, the sooner will the full scheme come to fruition.

## Special Articles

### HÆMATOLOGICAL TECHNIQUE

#### PART VII

By L. EVERARD NAPIER, F.R.C.P. (Lond.)

and

C. R. DAS GUPTA, M.B. (Cal.), D.T.M.

(From the School of Tropical Medicine, Calcutta)

#### (10) White cell differential count

WHEN making a white cell differential count, an attempt should be made to fulfil the following requirements:—

(i) The film should be uniformly spread and should be neither too thin nor too thick—the ideal film is one where the margins of the red cells when seen under the microscope just touch one another without over-lapping (*vide*, Part VI).

(ii) The film should occupy the middle two-thirds of the slide.

(iii) There should be no 'tails' at the end of the film.

(iv) The drop should be a small one so that the whole may be utilized in making the smear,

as, if only a portion of a large drop is used, this portion may not contain a fair sample of the cells (e.g., the large cells tend to sink to the bottom of the drop).

(v) The cells should be stained well and there should be no debris in between or on the cells.

A well-stained film shows—

red cells—an orange-buff colour,  
lymphocytes—with pale blue cytoplasm, and  
neutrophil granules—a dull lilac.

#### Number of cells to be counted

This will vary directly with the total white cell count, the higher the total count the larger is the number of the cells that should be counted to get a correct proportion of the different cells. The following rule may be taken as a guide, but need not be followed rigidly:—

Count 100 cells when the total white count is below 5,000 per c.mm.

Count 200 cells when the total white count is above 5,000 per c.mm. but below 10,000.

Count 300 cells when the total white count is above 10,000 per c.mm. but below 20,000.  
Count 400 cells when the total white count is above 20,000 per c.mm.

The differential count should be done with an oil-immersion lens (1/12) and an  $\times 5$  eyepiece with a  $\times 10$  eyepiece at hand. This magnification will enable one to see the details of the cells distinctly, but a higher magnification, given by the  $\times 10$  eyepiece, may sometimes seem desirable, e.g., in case of doubt arising as to the true identity of a cell. In actual practice it will be found that one seldom changes the eyepiece.

The microscope must be fitted with a mechanical stage that allows easy movement in either the horizontal or the vertical plane. Northern daylight is preferable to artificial light, as it shows the true colour of the different cells. If artificial light has to be used a blue filter should be placed in front of the light itself or under the condenser of the microscope.

*Procedure.*—Place the stained blood film on the mechanical stage of the microscope and fix it securely; with the low power (2/3 objective) make a rapid survey of the different parts of the film, to find out if the requirements mentioned above are fulfilled. If not, it is recommended that another, properly made, film should be stained, for to attempt to make a differential count on an unsatisfactory blood film is laborious and irritating, and the result obtained is never accurate.

If the blood film is satisfactory, put a drop of cedar-wood oil on the smear, rotate the oil-immersion lens into position, open the diaphragm fully and raise the condenser to get the maximum amount of light. With the coarse adjustment, lower the oil-immersion lens just to touch the stained film through the cedar-wood oil; then, looking into the microscope, gently raise the lens until the cells are seen, and finally manipulate the fine adjustment until the focus is accurate.

The distribution of the white cells in the different portions of the blood films depends on their size; the larger and heavier cells, e.g., neutrophils, eosinophils, and large mononuclears, are mostly found along the edges and at the tail end of a smear, while the smaller and the lighter cells, e.g., the lymphocytes, tend to occupy the middle of the film.

Therefore, in order to get an absolutely correct differential count every cell in the blood smear on the slide, or on both the coverslips used in making the smear if the coverslip method is used, must be counted and classified, and the percentage calculated. This takes a long time, particularly if the smear is a large one; it is therefore advisable to make as small a smear as possible.

A very small smear can be made by taking a large drop, with the corner of a slide touching this drop, transferring a portion of it to another slide, and making a smear, but this must be

done quickly before the cells settle (*v.s.*). If the cells counted on a *whole* small smear are over a hundred, it is better to accept this than to supplement it by a counting *part* of another film.

Otherwise, a smear is made from a small (initial) drop and one of the methods suggested below is adopted. From neither of these methods will the error be very great.

(i) Start counting at a point A, near the proximal end of the smear and along one edge, moving the slide longitudinally, counting and classifying the cells all the time, up to B which is beyond the end of the film; move the slide the breadth of one or two fields to B' and again move back along the whole length of the film to C, which is beyond the proximal end of the film; move across to C' and then back again up and down the film. Continue to do this until about the middle of the film is reached, or until a sufficient number of cells has been counted, but always end the counting at the end of the film (*vide* figure 1).

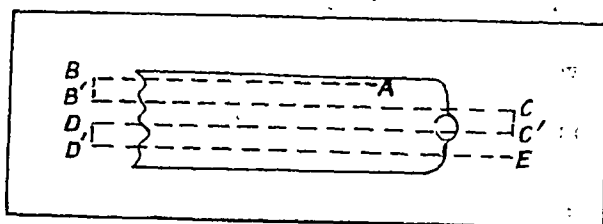


Fig. 1.

By this procedure you will have included one edge, and one or two fields from the rest of the film. The majority of the heavy cells are drawn to the distal end and only a few to the sides, so that the discrepancy will not be great if, after counting one edge, you count a little more or a little less of the rest of the film. On the other hand, it is important to finish at the end, so that you will have covered an even proportion of body and tail of the film. For this reason an exact figure should not be aimed at, but the point of stopping, like the point of starting, should be at the proximal end. The percentages of the different cells are then calculated.

*Example.*—Suppose that in making a differential white-cell count of a blood film there are 141 neutrophils, 63 lymphocytes, 12 monocytes, and 9 eosinophils, i.e., 225 cells altogether, the percentage of the different cells are calculated, and are:—

$$\text{Neutrophils} = \frac{141 \times 100}{225} = 62.6 \text{ or } 62.7 \text{ per cent.}$$

$$\text{Lymphocytes} = \frac{63 \times 100}{225} = 28.0$$

$$\text{Monocytes} = \frac{12 \times 100}{225} = 5.3 \text{ or } 5.3 \text{ "}$$

$$\text{Eosinophils} = \frac{9 \times 100}{225} = 4.0$$

(ii) *Fourfold meander technique.*—Though this method is recommended in most textbooks

we consider that it allows greater scope for individual variation in procedure, and we prefer the previous method; the method is as follows:—

From a point at the edge of the film move towards the centre of the film for about 4 'fields' then, using the other mechanical-stage adjustment, move about 4 fields towards the proximal end of the film, then back towards and beyond the edge, move a few fields towards the proximal end, and repeat the process until 50 cells have been counted and classified. This process should be repeated in four different places at the edge of the film, on either side and near each end of the film (*vide* figure 2).

#### Example 2.—

Neutrophils	..	10	12	14	17	20	4	10	14	1	20	10	Total	Per cent
Lymphocytes	..	4	3	5	8	5	1	8	4	1	10	2	132	= 68.0
Monocytes	..	..	1	1	1	1	..	1	1	..	1	..	51	= 26.3
Eosinophils	..	1	..	..	..	..	1	..	..	1	..	..	7	= 3.6
Basophils	..	..	..	..	..	..	..	..	..	..	..	1	3	= 1.5
													1	= 0.5
													194	

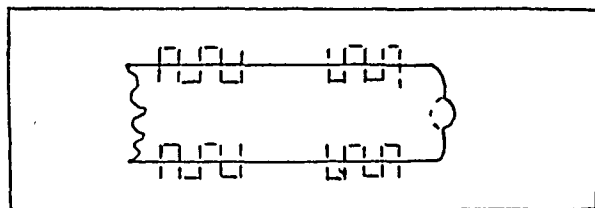


Fig. 2.

#### Recording the results

Except in cases of leukaemia and some rare pathological conditions, the types of white

#### Example 3.—

Neutrophils	..	18	17	10	14	16	14	20	11	Total	Per cent
Lymphocytes	..	6	5	12	8	7	9	4	9	120	= 60.0
Monocytes	..	0	3	2	1	2	1	1	3	60	= 30.0
Eosinophils	..	1	0	1	1	0	1	0	2	13	= 6.5
Basophils	..	0	0	0	1	0	0	0	0	6	= 3.0
										1	= 0.5

cells which are usually seen in the differential count of a peripheral blood film are neutrophils, lymphocytes, monocytes, eosinophils, and basophils, in the order of frequency in which they are encountered. As the slide is moved from one field of vision to another, the examiner must record both the total number and also the types of cells encountered.

This may be done in different ways:—

I. The usual method is to write down on a piece of paper the names of the cells in the order of frequency in which they usually occur in the peripheral blood and to put a vertical stroke against each cell which is seen in the field of vision, making the fifth stroke cross the other four, so that the strokes in groups of five are easily counted (*vide* example 1). When all the cells in the film, or in the case of a large film, in the area decided upon, have been counted, they are totalled, and the percentage calculated.

#### Example 1.—

N —									= 68
L —									= 32
M —									= 5
E —		/							= 6
B —	/								= 1

II. Another method is to memorize the numbers of the two main cell types until one of the other types is encountered, then to enter the count on your prepared list, and begin again. Thus:—

The numbers against each type are added and the percentages calculated.

III. A quicker method, which can be learnt with a little practice, is to remember the numbers of the different types of cells in the traditional sequence neutrophil, lymphocytes, monocytes, eosinophil and basophil until 25 cells have been counted; the number of each type counted is entered against the respective name on a piece of paper and when the required number of cells have been counted, they are totalled and the percentages calculated.

Method I is simple and fool-proof, but slow; method II is also simple and saves the repeated interruptions of method I; method III is very popular, but tends to make one stop at a round number and thereby simplify the calculation, which is a procedure not in the best interests of accurate countings.

In methods I and II, theoretically one has to stop periodically and add up all the figures to see if sufficient cells have been counted, but this can be obviated by the use of a mechanical counter, *e.g.*, the Veeder-Root hand tally. The 'counter' fits nicely into the hollow of the palm and is conveniently kept in the left hand. The knob is pressed with the thumb each time that a cell is seen and the numbers are at once recorded on the dial. The total number of cells counted at any time during the process of the differential count can be seen by simply looking at the dial of the counter.

*Expressing the results*

It is customary to express the result in the white-cell differential count as a percentage of the various cells encountered, without any reference to the total white cell count. This does not always convey the full significance of the observation, and both percentage and absolute figures should be given.

The absolute figures are readily obtained by striking out the last two zeros of the total leucocyte count, or moving the decimal point back two spaces, and multiplying each percentage by this figure, as in the example given below:—

*Example.*—(A fairly normal count).  
Total white-cell count—7,500 per c.mm.  
Differential white-cell count—

	Per cent	Total per c.mm.
Neutrophils ..	68.0	5,100
Lymphocytes ..	24.0	1,800
Monocytes ..	5.0	375
Eosinophils ..	2.5	187
Basophils ..	0.5	37

Now, if the patient were to take some toxic drug which reduced the neutrophils to a low figure, say to 500 per c.mm., but did not affect the other leucocytes, the total count would now be 2,900 per c.mm. and the percentages—

	Per cent	Total per c.mm.
Neutrophils ..	17.2	500
Lymphocytes ..	62.1	1,800
Monocytes ..	12.9	375
Eosinophils ..	6.4	187
Basophils ..	1.3	37

In this count the attention is attracted by the high lymphocyte and monocyte percentages, whereas actually these cell elements are normal and all that has happened is a decrease in neutrophils.

Again, in asthma there may be a sudden high rise in eosinophils which reduces considerably the percentage of neutrophils, even in cases where there has been an actual increase in this element, so that again a wrong impression is made.

Therefore, a differential count should always be given in absolute figures as well as in percentages.

*Normal white-cell counts.*—The normal leucocyte count in an adult is usually given as 7,000 to 9,000 per c.mm. Some of our findings in Indian populations are given below:—

From records of 114 normal females in which the full differential counts are available, we have calculated the following means:—

	Percentage	Per c.mm.
Neutrophils ..	62.6	4,507
Lymphocytes ..	26.9	1,937
Monocytes ..	5.5	396
Eosinophils ..	4.8	346
Basophils ..	0.2	14

It will be noted that the monocyte counts are all above the usual normal figure, but especially those in Assam, where malarial is very prevalent. The eosinophil figures are also high compared with European and American standards and they are exceptionally high in the Assam population, where the hookworm-infection rate is nearly 100 per cent.

*(11) Cell identification*

The first essential for accurate identification of the cells of the blood or marrow is a satisfactory and properly-stained blood film. A well-stained film should show no precipitate on or between the cells, the red cells should stain an orange buff, the neutrophil granules a dull shade of lilac, and in the monocyte the so-called 'azurophil granules' should just be visible—with any of the Romanowski stains.

The following system is recommended for the identification of different cells.

*Granules.*—First, ascertain whether the cytoplasm of the cells contains any granules, or not. If there are granules, decide whether the granules are neutrophilic, eosinophilic, or basophilic.

*Neutrophil* granules are small, uniform in size, uncountably numerous, and stain a dull shade of lilac.

*Eosinophil* granules are large, round, uniform in size, and stain orange-red with pale centres. They are not so numerous as neutrophil granules—occasionally eosinophil granules take on a bluish stain, even in a well-stained specimen, while in a badly stained one all may be bluish.

*Basophil* granules vary considerably in size in the same cell, they stain a dark blue-violet colour, which is entirely different from the colour of the nucleus; they are always coarser and fewer in number than the neutrophil or eosinophil granules. The granules are found not only in the cytoplasm, but also they are always found superimposed on the nucleus.

SUBJECTS		Residence	TOTAL LEUCOCYTE COUNT		MONOCYTES		EOSINOPHILS	
Number	Sex		Mean	S. D.	Mean	S. D.	Mean	S. D.
50	Males	Calcutta	6,542	± 1,214	7.00	± 3.91	6.90	± 5.19
128	Females	"	7,162	± 1,765			5.16	± 4.21
24	Males	Assam	8,166	± 2,650	9.44	± 4.32	13.76	± 8.8
17	Females	"	8,768		8.35		13.74	
25	Males	Cachar	7,111	± 1,759	..	..	..	..
25	Females	"	6,456	± 1,755				

TABLE I  
*Identification of cells without specific granules*

Nucleoli	Shape of nucleus	Chromatin structure	Size of nucleus in relation to cell	Cytoplasm	Azurophil particles	Name of cell	Identification mark
Present	Round, oval, or irregular. Ditto with irregular outline.	Fine	More than three-quarters	Clear light blue	None	Myeloblast	I
		Finer than I	" "	Clear deeper blue than I		Lymphoblast	II
		Relatively coarse	" two-thirds	Light blue, opaque		Monoblast	III
		Fine, stippled	" "	Dark grey-blue, ground glass with clear halo around the nucleus.		Megaloblast	IV
Present or absent	Round, oval, or irregular. Kidney or irregular Generally round or oval; may be clover leaf.	Coarse	More than half	Clear light blue	May be present	Large lymphocyte	IIa
		Coarser than III	" "	Light blue—opaque.		Pre-monocyte	IIIa
		Coarse; in clumps	More than half in larger cells but almost fills the cell in the smaller ones.	Clear transparent blue may appear only as a thin rim in the smaller cells.		Lymphocyte	IIb
		Coarse clumps or strands.	Half or more	Light, faded blue, opaque		Monocytes	IIIb
Absent	Round or oval	Coarse	More than two-thirds	Ground-glass greyish blue, with a little haemoglobin in some cases.	None	Erythroblast	IVa
		Very coarse	Variable, usually less than two-thirds.	Ditto with more haemoglobin.		Macroblast	IVb
		Pycnotic (nucleus almost black).	Variable, often less than half.	Grey, reddish-grey, or pink as in the red cells.		Normoblast	IVc
		Very coarse, cart-wheel appearance; eccentric.	Less than half	Deep greyish-blue ground-glass.		Plasma cell	V
		Coarse	Variable	Light blue obscured by azure particles.		Megakaryocyte *	VI

\* Mature platelets (VIa) which develop from the megakaryocyte are small (2 to 3 $\mu$ ) ill-defined structures, not clearly differentiated into nucleus and cytoplasm.

TABLE II

*Identification of cells containing granules*

Nucleoli	Nucleus	Granules	Cytoplasm	Cell	Mark	REMARKS.
Present	Round or oval; relatively fine chromatin structure.	Very few; fine, scattered.	Pale blue. Relatively small amount.	Pre-myelocyte	Ia	This, as well as the other granular cells may be neutrophil, eosinophil or basophil. Basophil pre-myelocytes are rarely identified.
Generally absent.	Round or oval; coarse chromatin structure; may not be very well stained.	Very prominent; coarse.	Very pale blue: variable in amount, but usually more than in Ia; not well seen, as it is covered by granules.	Myelocyte	Ib	In the eosinophil and basophil myelocytes, the cytoplasm is almost entirely covered by granules, and is rarely visible. In the basophil the nucleus also is blurred by granules.
	Bean- or kidney-shaped; coarse chromatin structure.	Granules less prominent than corresponding granules in Ib: numerous.	Large in amount. Very pale blue obscured by granules.	Meta-myelocyte or young forms.	Ic	The basophil meta-myelocyte and staff cells are very difficult to identify.
	Curved rod; coarse chromatin structure.	Finer and more numerous than corresponding granules in Ic.	Large amount. Very pale blue.	Staff (or band)	Id	
Absent	Lobed or segmented, 2 to 5 or more lobes.	Very fine and numerous: light lilac colour.	Large amount. Very light greyish-blue.	Neutrophil polymorpho-nuclear granulocyte.	Ie(i)	
	Usually bilobed; rarely may have more lobes.	Finer than eosinophilic precursor Id(ii), but coarser than Ie(i).	Very pale blue; scarcely seen.	Eosinophil granulocyte.	Ie(ii)	
	Segmentation of the lobes is difficult to make out, but never more than two lobes.	Very coarse; dark violet blue, almost black, often obscuring nucleus.	Very pale blue; scarcely seen.	Basophil granulocyte.	Ie(iii)	

Besides these specific granules, the presence of which characterizes the cells of the granular series, some cells of the non-granular series, *e.g.*, monocytes and lymphocytes, may show some stained particles in the cytoplasm of the cells which have been called 'azurophil granules'. These azurophil particles are of the same colour as the nucleus of the cell in which they occur, but may be paler, brighter, or darker. They vary in size, in depth of staining, and in number. In the lymphocytes the particles are few in number, they are large, coarse, and darkly stained, and occur in small groups in the cytoplasm, while the particles in the monocytes are more numerous, paler and finer, and are more evenly distributed in the cytoplasm.

Having noted whether granules are present or not, and if present the nature of the granules,

employ the following tables for the further identification of the cells:—

Table I gives the cells of the non-granular series, and table II those of the granular series.

The cells of the granular series all originate from the primary differentiated cell of that series, the myeloblast. They are arranged in the table in order of maturation.

The mature neutrophil, eosinophil and basophil have their specific precursors in the earlier cells of the series and these can be distinguished by the size and colour of their granules (*v. s.*); there are, thus, neutrophil, eosinophil and basophil, premyelocytes, myelocytes, metamyelocytes and staff cells.

Table III is a supplementary table to aid in the identification of primary differentiated cells which are already shown in table I.

TABLE III  
*Identification of the earliest differentiated cells*

Name of cell	Nucleoli	Nucleus	Chromatin	Nuclear membrane	Cytoplasm	Auer's bodies
I. Myeloblast	Few, not very distinct.	Round or oval; usually central.	Fine reticulation.	Not distinct and no condensation of chromatin at edges of nucleus.	Clear light transparent blue.	May be seen occasionally.
II. Lymphoblast	Many, very distinct.	Round or oval and central.	Finer reticulation.	Distinct with condensation of chromatin at the edges.	Clear deeper blue.	Not seen.
III. Monoblast	One or two often clean cut.	Round or oval; often folded.	Relatively coarse.	Not distinct and no condensation of chromatin at edges.	Light blue, not so transparent.	Frequently seen.
IV. Megaloblast	Few, appear as irregular gaps.	Round or oval; large.	Fine, stippled.	Not distinct and no condensation of chromatin at edges.	Grey-blue ground-glass, with halo round nucleus.	None.

TABLE IV  
*Identification of the different nucleated cells of red cell series*

Cell	Size	Cell outline	Cytoplasm	Nucleoli	Nucleus	Chromatin
IV. Megaloblast	16-21 $\mu$	Irregular	(i) Dark blue-grey (basophilic). (ii) Polychromatic or eosinophilic (Ehrlich's megaloblast).	Present, few, appear as irregular gaps.	Large; occupies more than two-thirds of the cell; sometimes eccentric.	Fine, stippled, stains lightly.
IVa. Erythroblast	12-18 $\mu$	Regular	Basophilic, polychromatic or eosinophilic.	Absent	Central and smaller than that of (IV); occupies over two-thirds of cell.	Coarse, less reticular, deeply-staining.
IVb. Macroblast	7-14 $\mu$	Regular	Basophilic, polychromatic or eosinophilic.	Absent	Usually central and occupies more than half.	Very coarse, reticular, deeply-staining.
IVc. Normoblast	5-10 $\mu$	Regular	Polychromatic or eosinophilic.	Absent	Sometimes eccentric; may be lobed or clover leaf.	Pycnotic, appears as drop of ink.

The points of difference in the morphology of the different primary cells are very fine and at times it is almost impossible to distinguish one from the other. In cases of leukæmia or anæmia the identification of an individual cell has often to be made, not on the cell alone but on the characteristics displayed by 'other associated cells; in other words, the cell is judged 'on the company it keeps'.

Table IV is also supplementary. It gives the nucleated cells of the red cell series in order of maturation.

#### *The development of blood cells*

We do not propose to discuss the origin of the cells found in the blood stream, for it is a controversial field in which 'unitarians', 'dualists', and 'trialists', of the monophyletic and polyphyletic schools argue with one another to the

confusion of the practical hæmatologist. We are only concerned with the already differentiated cells, the immediate precursors of the normal and abnormal cells of the peripheral circulation.

It is, however, impossible to avoid controversy altogether, as this is intimately associated with nomenclature which is definitely our domain, for at present much confusion in the literature is due to different writers adopting different names for the same cell, and the same name for different cells.

We have followed the Sabin school in using the word 'megaloblast' for the earliest differentiated precursor of both normal and abnormal red cells, and have used the expression 'Ehrlich's megaloblast' for the hæmoglobinized megaloblasts that are encountered in Addison's pernicious anæmia and rarely in other macrocytic anæmias. Some writers refer to 'our' normal



megaloblast as a basophil erythroblast, an early primary erythroblast, a pronormoblast, or even as a hæmocytoblast (which name most writers reserve for the common stem cell).

With reference to the other cells, we have taken the view that the granulocytes, lymphocytes, monocytes and platelets have each a separate differentiated precursor cell, and following the usual practice we have called these myeloblast, lymphoblast, normoblast, and megakaryocyte, respectively.

*Red cells.*—Normally, the red cells originate intravascularly from the endothelial cells of the sinusoidal spaces and capillaries of the bone marrow. The first differentiated cell is the megaloblast. As development proceeds, the megaloblast passes through the stages of erythroblast, macroblast, normoblast and reticulocyte to develop into the mature erythrocyte (*vide* schema). In the process of maturation the nucleus loses its nucleoli very early, so that these are not seen in the erythroblast; the nucleus also loses its reticular structure and becomes gradually coarser and coarser as development proceeds, until in the normoblast it becomes completely pycnotic; after this the nucleus is lost (by fragmentation or extrusion) and the erythrocyte becomes fully mature. The reticulocyte is a stage between the normoblast and the fully-mature red cell, but the reticulations are not seen in a Romanowski-stained film.

*Granulocytes.*—The granular cells develop extravascularly from the reticulo-endothelial cells of the bone-marrow. The earliest differentiated cell is the myeloblast.

The first evidence of maturation of the myeloblast is the appearance of granules in the cytoplasm. At first the granules are very fine and few, as in the pre-myelocytes, but gradually they become more numerous and coarser, and are coarsest at the myelocytic stage, after which the granules again become finer and less numerous as development proceeds. In the fully-developed neutrophil polymorphonuclear cells the granules are very fine and numerous. The cells can be differentiated as neutrophil, eosinophil and basophil according to the colour and size of their respective granules, with difficulty at the premyelocyte stage but quite easily from the myelocyte stage onwards.

In the process of development the nucleus loses its nucleoli; these are ill-defined in the premyelocyte and are almost always absent from the myelocyte stage onwards. The chromatin structure of the nucleus which is finely reticular in the myeloblast becomes coarser and more condensed as development proceeds, and is very dense at the later stages; this condensation makes the nucleus smaller. The shape of the nucleus too changes from round or oval at the earlier myeloblast, premyelocyte, and myelocyte stages to kidney or bean shape at the metamyelocyte stage, and then it becomes elongated in the staff, and finally lobulated in the segmented forms.

The cytoplasm which is blue and scanty in the myeloblast loses its colour gradually and becomes more abundant as development proceeds—in the later stages the cytoplasm is hardly visible as it is covered by the granules.

*Monocytes.*—The monocytes originate from the reticulum all over the body but particularly from that in the spleen. The first differentiated cell is the monoblast; it proceeds through the stage of the premonocyte to the stage of fully-developed monocyte. As development proceeds, the nucleus loses its nucleoli and the fine reticular structure becomes coarser, and very fine and numerous azure particles appear in the cytoplasm of a fully-developed monocyte. The nucleus which is round or oval in the monoblast, becomes slightly indented in the premonocyte, and may take on various shapes in the mature monocytes. (We have made no attempt to differentiate between monocytes and histiocyte; this can only be done by a supra-vital staining process which we are not describing here. Some of the large mononuclear cells in the peripheral blood are undoubtedly histiocytes, whose origin is probably different from that of the monocytes.)

### *Lymphocytes*

The lymphocytes originate mainly from the lymphatic tissue of the lymph glands all over the body and to a small extent from the lymphoid tissue in the marrow. The first differentiated cell is the lymphoblast which proceeds through the stage of large lymphocyte to the fully-developed (small) lymphocyte.

In the process of development the nucleus loses the nucleoli, the fine chromatin structure becomes coarser, and finally pycnotic in the mature cells. The cytoplasm which is definitely blue in the lymphoblast becomes lighter in colour as development proceeds, but is always transparent. In some of the older cells a few coarse irregularly scattered azure particles may be seen.

### (12) *Technique of sternal puncture*

Bone puncture as an aid to accurate diagnosis of blood diseases and to the study of their ætiology has only come into general use during the last few years; the main reason for this was that the methods used for obtaining material from the bones were comparatively difficult, and usually painful, unless an anæsthetic were given, before the Salah sternal-puncture needle was introduced. This handy and inexpensive instrument is now used widely not only in hæmatological work but in the diagnosis of kala-azar and other protozoal and bacterial diseases. We have used this needle for about four years and have adopted sternal puncture as a routine procedure in all cases of anæmia.

The senior writer described this technique in a paper written in co-operation with Dr. P. C. Sen Gupta,\* (Napier and Sen Gupta, 1938);

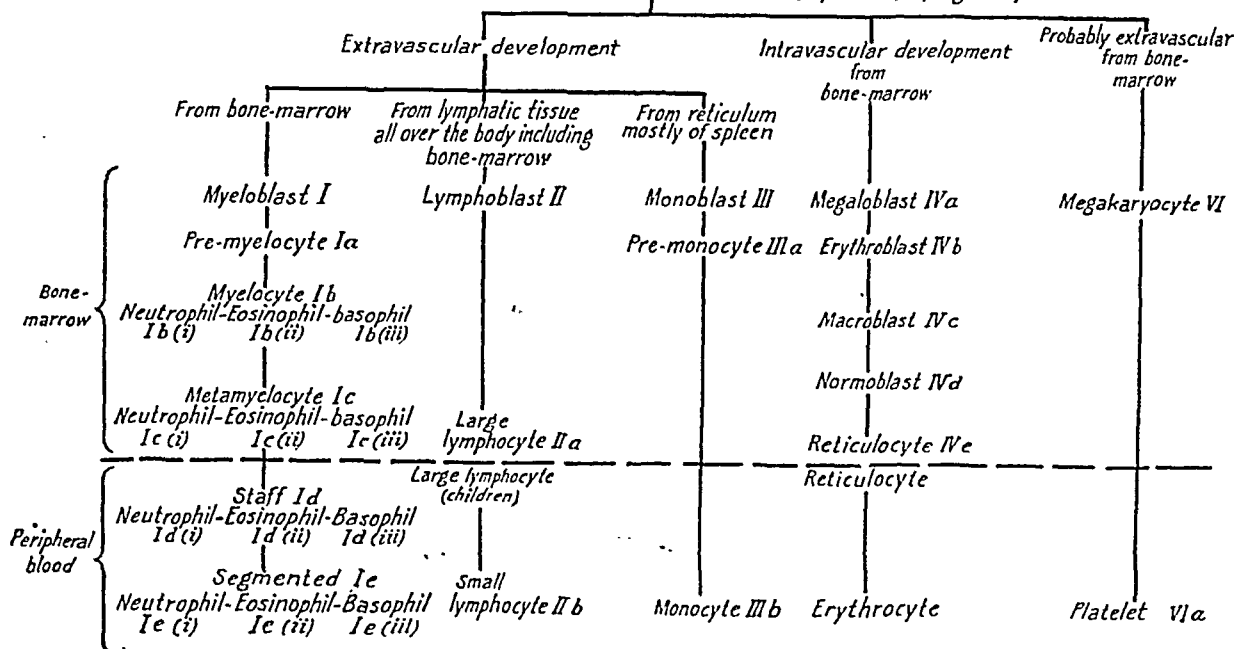
\* With whose kind permission the figures from this paper have been reproduced.

since then, as a result of further experience, certain modifications in technique have been introduced and these are incorporated in this description, but the technique described is materially the same as that given in the above-mentioned paper.

steel and the bore is about the same as that of a lumbar puncture needle. The guard C on the needle can be moved so as to adjust the depth of the puncture. Usually the guard has to be fixed at a distance of 1 to 1.5 cm. from the tip, in order that the marrow may be reached. This

#### Origin of blood cells.

*From reticulo-endothelial system in bone-marrow, spleen, lymph glands, etc.*



#### Apparatus required.

1. The sternal-puncture needle.
2. Two Record syringes, 2 c.cm.
3. A pair of scissors and a shaving set.
4. Two per cent solution of novocaine or any of its substitutes. (Pitumerit 4 per cent solution produces good anæsthesia.)
5. Absolute alcohol and ether.
6. Collodion or tincture of benzoin.
7. Cotton-wool, etc.

The needle is dry-sterilized in a hot-air sterilizer in a test-tube. The syringe is sterilized by boiling and then dried thoroughly by first driving out water with alcohol and later alcohol with ether, and finally by drawing in and expelling hot air (through the flame of a gas burner or spirit lamp).

#### The sternal puncture needle

The Salah needle used for sternal puncture is shown below (figure 3). It is made of rustless

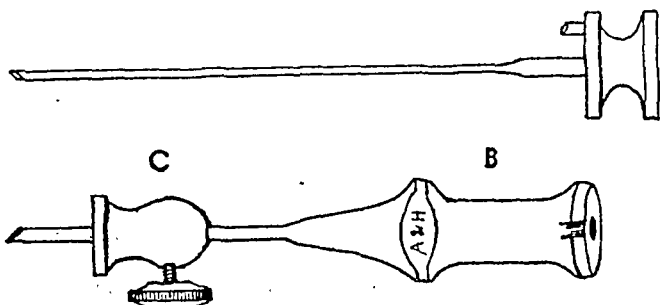


Fig. 3.—Needle B with stylet A removed: movable guard C (actual size).

distance will vary with the thickness of the skin and subcutaneous tissue of the thoracic wall; in fat individuals up to 2 cm. may be required and in very emaciated ones less than 1 cm. It may be found advisable to readjust the guard after the needle has reached the periosteum, before it is pushed through the outer plate into the marrow cavity. The stylet A is kept in while the puncture is being made and is withdrawn after the cavity is reached.

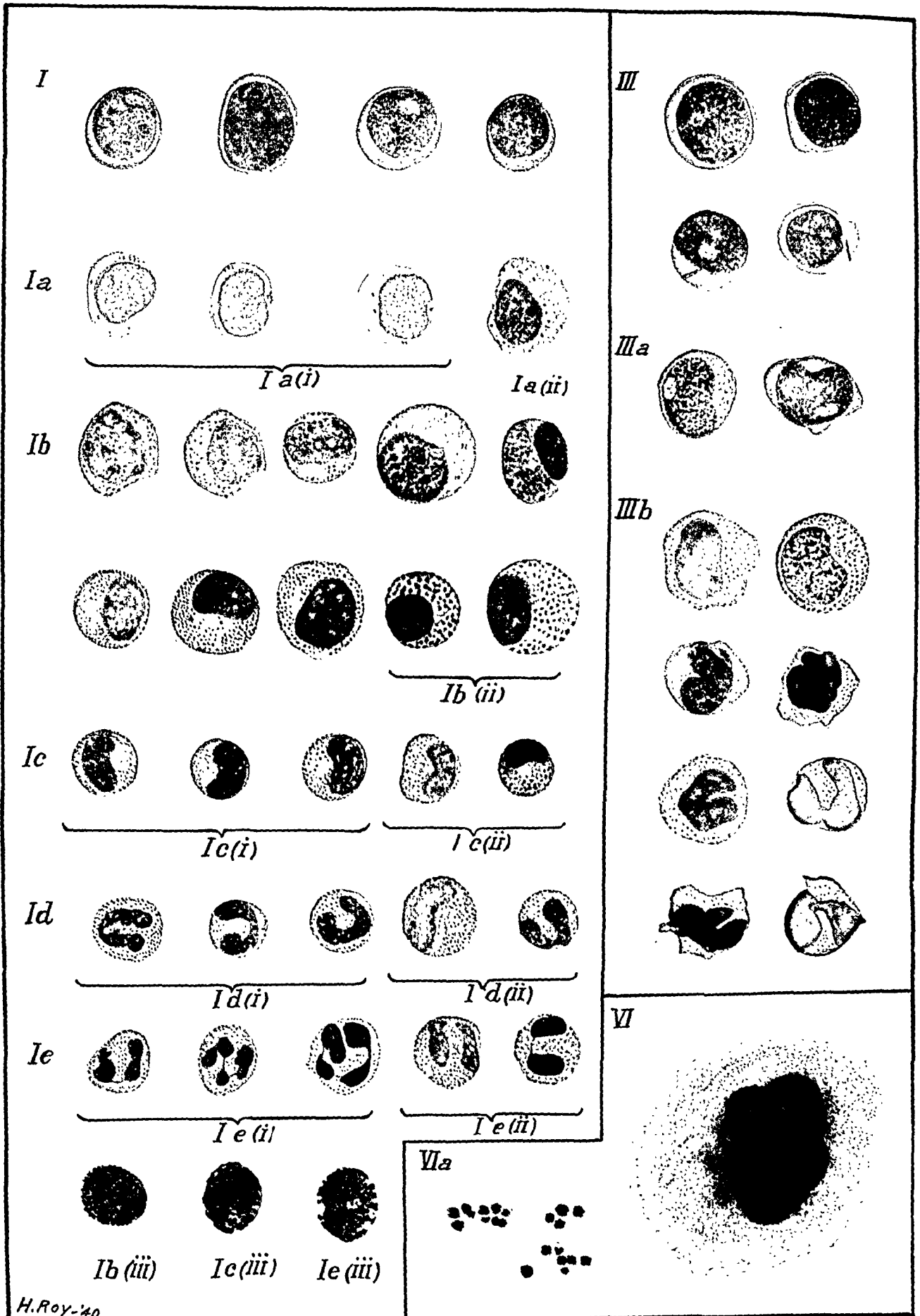
#### Procedure

The hair over the sternum, if there be any, is first clipped with a pair of scissors, shaved with a razor, and the skin finally cleaned thoroughly with alcohol. The best site for the puncture is just to one side of the middle line at the level of the second intercostal space. This area is first anæsthetized by infiltration with a two per cent solution of novocaine, or its substitute.

Some solution is first injected into the skin with a fine needle attached to a 2-c.cm. syringe, then the needle is pushed down to the periosteum and the rest of the solution injected. About one c.cm. is usually sufficient in a thin individual, but more is required where the subcutaneous tissue is deeper. After an interval of five minutes or so, the actual puncture is made.

The apparatus is held with the knob of the stylet in the palm of the hand and the needle itself between the thumb and index finger, the latter on the guard C of the needle. Pressure

—



## PLATE I

### I. *Myeloblasts.*

- Ia. *Premyelocytes* showing azur particles: the fourth cell, an eosinophil precursor, is slightly more mature than the rest.
- Ib. *Myelocytes*; the cells in the upper are less mature than those in the lower row: the first three in each row are neutrophils and the last two eosinophils.
- Ic. *Meta-myelocytes*; the last two (Ic<sub>ii</sub>) are eosinophils (the last cell in the row has not been reproduced well and has lost the red coloration that was apparent in the original drawing).
- Id. *Staff or band forms*, the last two being eosinophils (Id<sub>ii</sub>). (The colour of the last two is too red; the purple colour of the nucleus is sometimes obscured by the eosinophil granules, but not to the extent indicated here.
- Ie. *Mature granulocytes*, the first three being neutrophils and the last two eosinophils.
- Ib(iii), Ic(iii) and Ie(iii). *Basophils*, myelocyte, meta-myelocyte and mature. The shape of the nucleus is the only feature on which the immature forms are identified. In the original drawing the shapes of the nuclei were just discernible, but in the reproduction they are obscured.

### III. *Monoblasts*, the lower two showing Auer's bodies.

#### IIIa. *Premonocytes.*

- IIIb. *Monocytes*; the second cell in the top row might be classed as a premonocyte, but the azur particles are well developed. (There should be more blue colour in the cytoplasm of these cells.)

### VI. *Megakaryocyte*; these cells are often proportionately much bigger than the one shown.

#### VIa. *Platelets.*

Magnification about  $\times 1,000$ .

Staining—May-Grünwald and Giemsa.

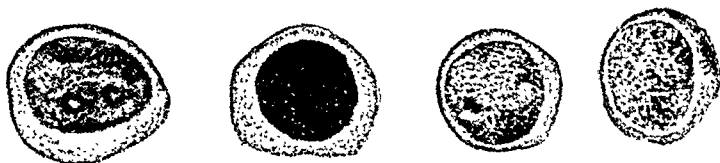
PLATE II

- IV. *Megaloblasts* (in the fourth cell the nucleus is much too red).
- IVa. *Erythroblasts*; in the fourth cell a considerable amount of hæmoglobin has developed.
- IVb. *Macroblasts*; the second and third are well hæmoglobinized; the last two are small varieties.
- IVc. *Normoblasts*; in the second cell the nucleus is dividing and about to be extruded.
- IVd. *Reticulocytes*.
- IVe. *Erythrocytes*: mature red cells.
- (i) Red cell showing Howell-Jolly bodies.
  - (ii) Red cell showing Cabot's rings.
  - (iii) Misshapen red cell.
  - (iv) Red cell with basophilic stippling.
- II. *Lymphoblasts*.
- IIa. *Large lymphocytes* with azur particles.
- IIb. Mature (small) *lymphocytes*: the first with azur particles. Below the lymphocyte series are two *Türk's cells*; the characteristic cart-wheel structure of the nucleus is not very clear.
- V. *Plasma cells*.
- Cresyl-blue supra-vital staining (*see* Part III).
- Erythrocytes: reticulocytes: platelets.*

Magnification about  $\times 1,000$ .

Staining—May-Grünwald and Giemsa, except figures in row IVd which are stained first with cresyl-blue and then Wright's stain [*vide* Part III, method A(b), i], and the block in the left lower corner in which all the cells are supra-vitally stained with cresyl-blue (*vide* Part III, method Bii).

IV



IVa



IVb



IVc



IVd



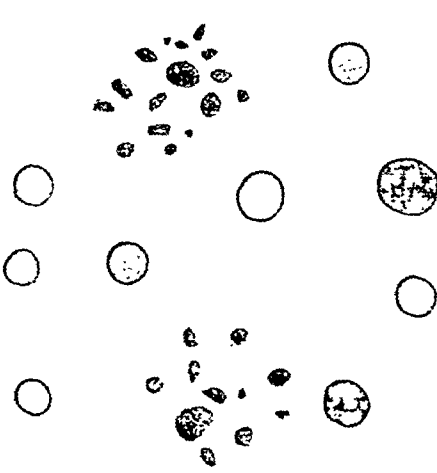
IVe



IVe



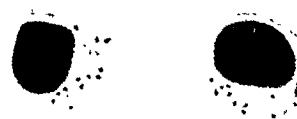
*Cresyl-blue staining*  
Red cells;  
Reticulocytes;  
Platelets.



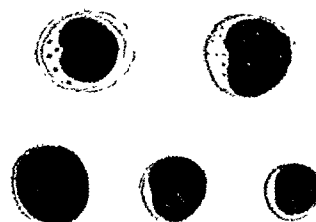
II



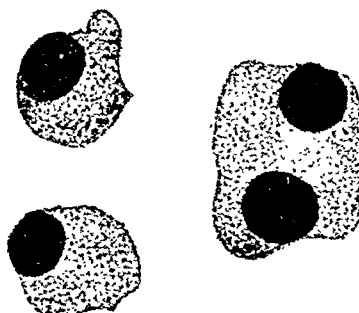
IIa



IIb



V







is applied and the skin and subcutaneous tissues are pierced; a rotary movement will then facili-

is pierced and the marrow cavity is entered, there is a sensation of loss of resistance, just

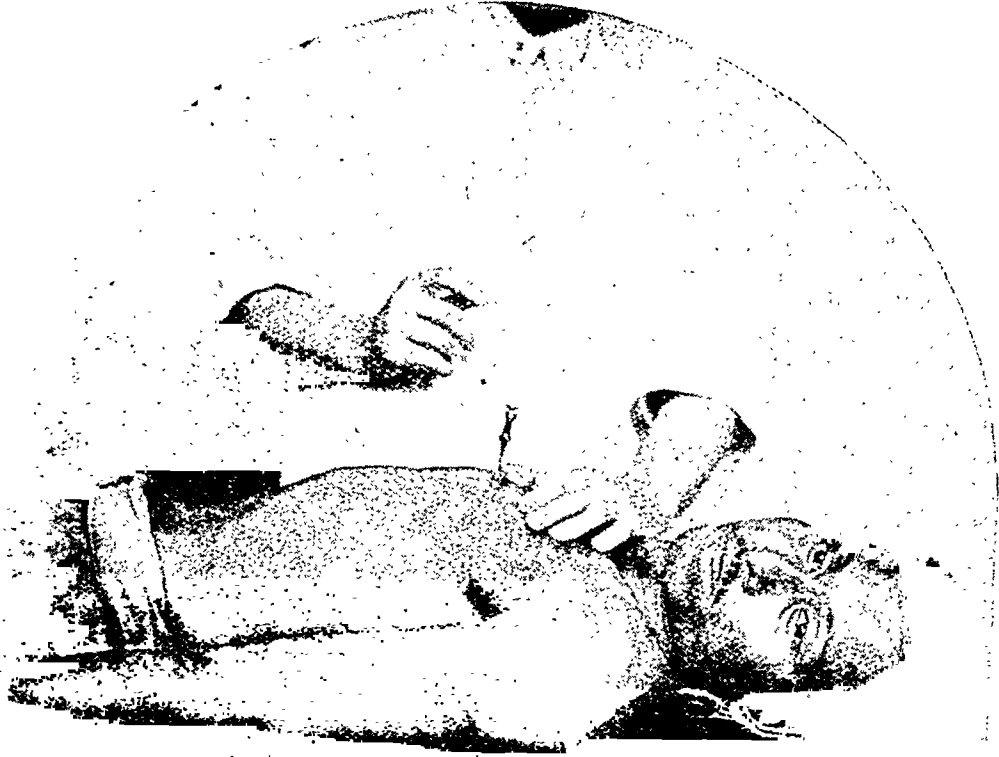


Fig. 4.—Needle in position after the marrow cavity has been penetrated.

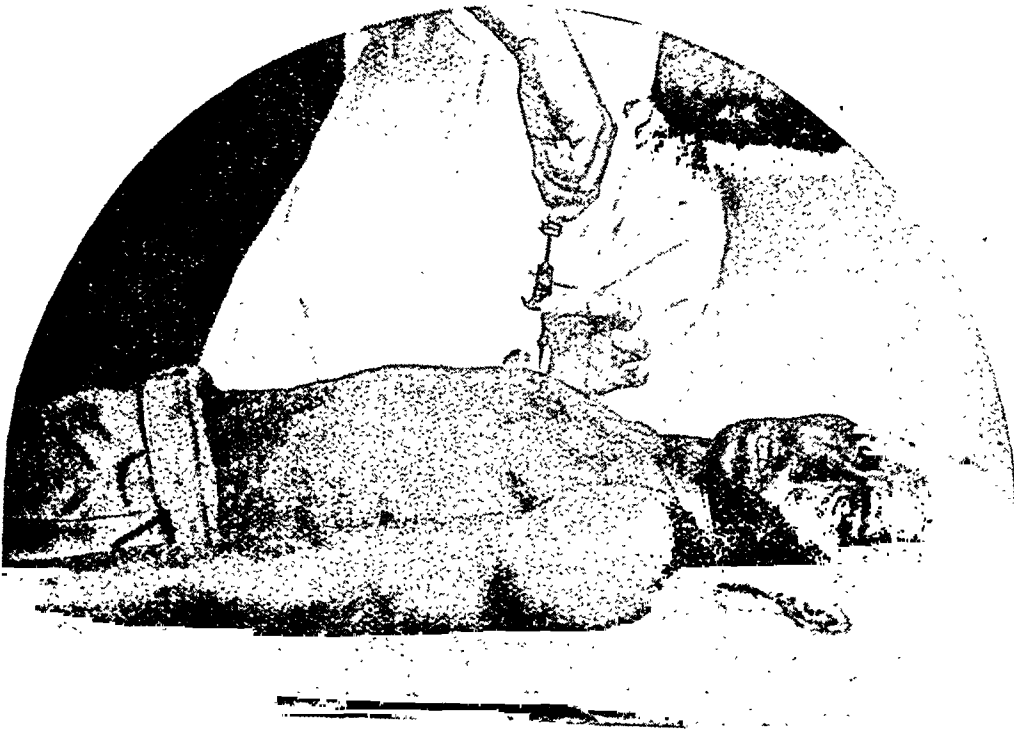


Fig. 5.—The stylet has been removed and sinusoidal blood is being drawn into a Record syringe, usually the only painful part of the operation.

tate puncture of the outer plate of the sternum (figure 4). As the external plate of the sternum

as is felt on entering the spinal canal during lumbar puncture. The stylet is now taken out,

the 2-c.cm. Record syringe is attached to the end of the needle, and the marrow blood is aspirated. When the fluid is aspirated the patient feels a dragging pain (figure 5) which is a guide as to whether the needle is in the marrow cavity or not. About 0.5 c.cm. of marrow (sinusoidal) blood is removed and the syringe and the sternal-puncture needle are withdrawn; digital pressure is applied over the puncture for a minute or two and the puncture is sealed with collodion. The needle is detached from the syringe and the latter is inverted several times so as to mix the contents thoroughly; then small drops are placed on clean slides and smears are made (*vide* Part VI). The rest of the fluid is put into an oxalate tube.

Only very rarely will one fail to obtain blood. The commonest error is to fail to allow a sufficient length of needle. In this case the guard must be adjusted slightly, the stylet replaced, and the needle pushed in a little deeper. Occasionally, the needle goes too deeply and has to be withdrawn slightly before blood will come. Our only complete failure was in a case of leucæmia, and in none of our cases of leucæmia has the blood come freely.

Not more than 0.5 c.cm. of blood is aspirated, because, if more is drawn, there is a probability that the negative pressure in the marrow cavity will draw blood from the vessels in the locality, and thus dilute the sinusoidal blood; it is probably impossible entirely to prevent this occurring, therefore a constant amount of blood is drawn to obviate gross differences in the degree of dilution in the samples taken from different persons. The syringe is inverted several times in order that the contents may be mixed thoroughly. This is necessary because the fluid that comes out at the beginning is not the same as regards cellular content as the fluid that comes out towards the end of the aspiration\*.

#### *Examination of material*

##### (1) Examination of the stained smears :—

The sternal puncture smears are best stained with combined May-Grünwald and Giemsa staining which show the nuclear details very clearly. Failing this, satisfactory results for ordinary work may be obtained by staining with Leishman's or Wright's stain (*vide* part VI).

An accurate differential count of the different nucleated cells is made by counting 500 or more nucleated cells from different parts of a well-stained smear. The criteria on which the different cells are identified are given above.

##### (2) The oxalated specimen is examined for :—

(a) enumeration of total nucleated cells (*vide* Part II),

(b) estimation of hæmoglobin (*vide* Part I),

(c) enumeration of red cell (*vide* Part II), and

(d) estimation of reticulocyte percentage (*vide* Part III.)

#### *Discussion*

The material which is obtained by this procedure is neither peripheral blood (obviously) nor bone-marrow, but is blood from both the patent and the closed sinusoidal spaces in the hæmopoietic tissue of the bone-marrow, in which are mixed a few cells detached from the walls of these sinuses by the intruding needle, or by the act of aspiration. The extent to which the detached tissue cells are added to the sinusoidal blood probably varies with each puncture and constitutes the weakness of the procedure from the point of view of obtaining a true and unvarying picture of bone-marrow hæmopoietic activity. However, the extreme variations in a single subject that have been reported by some workers and the differences in the normals given by different workers can probably to some extent be accounted for by variations or defects in the technique employed, *e.g.*, by the failure to remove a small and constant amount of blood, by failure to mix the blood before making smears, or by making counts from one part of the blood film only.

Zanaty (1937) has pointed out that wide variations may exist in the total nucleated-cell counts and that from these counts little idea of the activity of the bone marrow can be obtained, but from our experience of sternal puncture we believe that there is generally a distinct correlation between hæmopoietic activity and the total nucleated cell count, though this may on occasions be misleading.

Both the hæmoglobin and red cell count are slightly lower and reticulocyte count slightly higher in the sinusoidal blood than in the venous blood, but these estimations are of little practical value.

#### *Normal standards*

It is useful to know what proportions of the various cells one may expect to find in a sternal puncture. The data given by various writers are difficult to correlate, because they have adopted different methods of classification and different nomenclatures, and we prefer to quote only our own findings.

The data given in tables V and VI are from two sources :—

(a) First series : 10 normal individuals, males; 2 c.cm. of fluid taken.

(b) Second series : 53 subjects infected with filariasis; 0.5 c.cm. of fluid taken.

We have quoted the latter series because we believe that they represent the findings in normal individuals very closely, and because it is not easy to persuade 50 perfectly healthy individuals to undergo a sternal puncture. One might expect them to differ from the normal in the matter of the eosinophil cells, but in actual fact the percentage is lower than in the first normal series. The material differences that will be noted between the two series are almost

\* *Vide* Ann. Rep., Calcutta School of Trop. Med. for 1938.

TABLE V  
Sternal puncture: normal data

	FIRST SERIES		SECOND SERIES	
	Mean	Standard deviation	Mean	Standard deviation
Hæmoglobin in grammes per 100 c.cm. .. ..	13.43	± 0.93	..	..
Red cells per c.mm. in millions .. ..	4.99	± 0.40	..	..
Reticulocytes—percentage of red cells .. ..	0.75	± 0.39	..	..
Total nucleated cells per c.mm. .. ..	53,500	± 26,500	111,678	± 64,832
Nucleated red cells—percentage of total nucleated cells .. ..	25.75	± 4.07	27.606	± 11.746
Leucocytes—percentage of total nucleated cells .. ..	74.25	± 4.07	..	..
Granulocytes—percentage of total nucleated cells .. ..	64.40	± 5.10	54.529	± 11.421
Non-granular leucocytes—percentage of total leucocytes .. ..	9.85	± 2.43	17.889	± 6.796
Myeloid/nucleated-red-cell ratio .. ..	2.50	..	1.975	..

TABLE VI  
Sternal puncture differential nucleated-cell count

				SERIES I		SERIES II		
				Range	Mean	Range	Mean	Standard deviation
Nucleated red cells ..	Megaloblasts ..	..	..	0.0 to 1.5	0.7	0.0 to 3.25	0.92	± 0.7366
	Erythroblasts ..	..	..	0.4 to 10.0	3.4	0.0 to 3.3	0.49	± 0.6619
	Macroblasts ..	..	..	..	..	0.0 to 8.75	2.075	± 1.7675
	Normoblasts ..	..	..	16.0 to 25.5	21.6	7.5 to 63.2	24.17	± 10.4505
White cell series ..	Myeloblasts ..	..	..	0.4 to 1.5	1.2	0.0 to 0.75	0.15	± 0.2670
A. Granular series ..	Pre-myelocytes ..	..	..	0.0 to 1.5	0.7	0.0 to 2.0	0.44	± 0.4409
	Myelocytes—	..	..	..	..	..	..	..
	Neutrophil ..	..	..	1.0 to 9.5	4.4	1.0 to 18.75	8.30	± 3.2061
	Eosinophil ..	..	..	0.4 to 2.6	1.3	0.0 to 4.0	1.445	± 0.9498
	Basophil ..	..	..	None found.		None found.		
	Meta-myelocyte-neutrophil ..	..	..	6.4 to 15.0	9.7	0.4 to 8.25	2.76	± 1.7257
	Staff or band neutrophil ..	..	..	14.6 to 38.5	25.3	12.4 to 60.0	33.91	± 9.1938
	Segmented neutrophil ..	..	..	6.5 to 25.6	16.8	0.0 to 23.6	5.35	± 5.0232
	Mature eosinophils ..	..	..	0.0 to 7.6	4.7	0.0 to 7.4	2.77	± 1.6539
	Basophils ..	..	..	0.0 to 1.0	0.2	0.0 to 1.2	0.08	± 0.2090
B. Non-granular series	Lymphocytes ..	..	..	3.0 to 12.0	6.25	2.9 to 34.5	15.68	± 7.2623
	Large mononuclears ..	..	..	1.2 to 7.0	3.0	0.0 to 3.5	1.585	± 0.9386
	Plasma cells ..	..	..	0.0 to 1.6	0.6	0.0 to 1.25	0.31	..

certainly due mainly to the fact that in the second series we took a smaller amount of fluid and that there was consequently less dilution by systemic blood.

The main discrepancies are higher total nucleated cell count in the second series—higher than the 'normal' figure usually quoted, a lower myeloid/nucleated-red-cell ratio—also lower than the usual normal figure, a higher lymphocyte percentage, a higher staff neutrophil percentage with correspondingly lower percentages of both young forms and segmented neutrophils—which may be due to the personal factor, and a higher maximum figure for most of the cells—which may be due to the larger number of subjects involved in the second series: the 63.2 per cent for nucleated red cells can scarcely be classed as 'normal'.

For the findings of other workers reference should be made to Zanaty (*loc. cit.*), and Scott (1939).

Many writers claim that megaloblasts are not present in the normal sternal puncture material. This is a matter of nomenclature. The cell we have described as a megaloblast (*v. s.*) is seen in the normal marrow.

We seldom identify cells as lymphoblasts or monoblasts in cases of anæmia, but myeloblasts are occasionally found and appear in most of our counts, forming 0.1 to 0.2 per cent of the nucleated cells. In a properly-drawn and well-stained smear, there are very few 'disintegrating cells' and practically all the nucleated cells seen can be identified; in a highly active marrow, however, there are some cells which show mitotic division and are difficult to identify properly.

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## ORGANIZATION OF PUBLIC HEALTH AND MEDICAL SERVICES IN INDIA

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(Abstract from the Presidential Address, National Institute of Sciences of India)

THE Indian Empire, excluding Burma and Ceylon, extends from Persia and Afghanistan on the west to the borders of China on the east, and from about latitude 40° in the north to almost the equator in the south. This vast area, which presents a land of very varied contrasts in almost all respects, such as its physiography, climate, flora, fauna, anthropology, history, etc., came under the influence of European civilization at a relatively late date, but very material advances in almost all directions have resulted from this contact. Even in regard to this influence, however, the contrasts presented in different parts of the country bring out very vividly the vast nature of the extremely varied problems which had and have to be faced in the length and breadth of this great sub-continent.

Confining our remarks, as it is proposed in this communication, to the public health and medical services in this country, it is apparent that side by side with the most modern, up-to-date and efficient machinery such as is to be found to-day in any other part of the world, the state of affairs in many of the areas is almost as primitive as it was during the Moghul times or even earlier.

During the early times there was a relatively highly evolved system of curative medicine in vogue throughout the country. This was particularly well developed during the hey-day of Buddhism in the country, but the highly important preventive side was, as in almost all other countries during this period, non-existent. Contact with the West marked a material change, and one of the outstanding points of this change was that, with the exception of a relatively small number of private practitioners of the indigenous systems of medicine, the State assumed almost the entire responsibility for providing medical relief to the country. Hospitals, dispensaries and other adjuncts, together with the necessary personnel, were provided on a fairly liberal scale, but these were far from sufficient for the teeming millions of this great land. Further, in essentials all this provision concerned itself for a long time with the curative rather than the preventive side of medical relief. Within recent years in a few of the larger towns some public-spirited people or communities have also provided additional institutions of curative medicine, while the numbers of private practitioners have also materially increased. All the same, the present position is far from satisfactory, and, in view of the impending constitutional changes, it is proposed in this communication to take stock of the situation and suggest what should be done for improving the existing conditions.

### *Landmarks in public health administration in India*

In the history of development of the Public Health Administration in India at least three landmarks have to be considered:

I. The appointment of a Royal Commission to enquire into the health of the army in India in 1859.

II. The report of the Plague Commission in 1904, following the outbreak of plague in 1896.

III. The Reforms introduced by the Government of India Act of 1919.

The Royal Commission of 1859 was appointed to enquire into the extremely unsatisfactory conditions of the health of the army in the country. Between 1859 and 1863, the mortality among European troops was 69 per 1,000, while among European women in 'married quarters' the death rate varied from 44 to 276 per 1,000. The Royal Commission recommended measures not only for the army but also for the civilian population. In accordance with its suggestions 'commissions of public health' were established in

Madras, Bombay and Bengal in 1864. The Commissions in Madras and Bengal advocated far-reaching measures, including the employment of trained public health staffs in the districts, but owing to various causes no definite policy was laid down. In the words of a former sanitary commissioner with the Government of India, 'Government had to deal with a population which was unwilling and unready to receive sanitation, which either frankly disbelieved in its efficacy and resented any change in established customs or was too ignorant and apathetic to understand the goal at which it aimed. Sanitary measures were received not only by indifference but by active opposition'. Under the circumstances, very little advance was possible, but the outbreak of plague in 1896 produced a profound effect which can best be summed up in the words of the sanitary commissioner at that time:

'When plague appeared it was not a new disease, but it was new to the present generation in Indians and it has exacted a very heavy toll of deaths all over the country. The strangeness of the disease, the unpopularity of the measures taken to control it and the importance of these measures have served to rouse the people from their apathy and concentrate the attention of all, but especially of the educated classes, on sanitation in a way that nothing else could have done.'

'At the same time plague has not been without its effect on Government. Previous to the advent of this disease it had been the generally accepted opinion that sanitation was the work of any medical officer and required no special training. A special sanitary staff had, therefore, not been considered of any very great importance. When plague appeared the staff was inadequate and unprepared; action was taken on general principles and sanitary measures were adopted, which, with further study of the aetiology, we now know were unsuitable and could do little to check the spread of the disease. The waste of life, time, money and effort that resulted has impressed on Government the necessity of being prepared in future and large changes have been effected with that object.'

### *The Plague Commission*

The report of the Plague Commission in 1904 advocated the reconstruction of the sanitary department on a wide imperial basis, with the establishment of adequate laboratory accommodation for research, teaching and the production of sera and vaccines. The Indian Research Fund Association was formed in 1911 and a forward sanitary policy, with a devolution of powers to the local governments, was formulated in a resolution of the Government of India in 1914.

The Reforms of 1919 had a very marked effect on public health administration; this was partly beneficial and in other respects detrimental. Provincial ministers responsible to the legislature were anxious to hasten the growth of education, medical relief and sanitation so far as funds permitted. The organization of trained public health staffs for urban and rural areas, which the 'commissions of public health' had recommended in the sixties of the last century, was at last taken up in earnest and in the years succeeding the introduction of the Montague-Chelmsford Reforms, the organization of health services became a marked feature in most provinces. Since 1921 there has indeed been far greater public health activity in the provinces than ever before.

All civil medical services in the presidencies and provinces were formerly under the control of a single administrative officer known as the surgeon-general in the former and the inspector-general of civil hospitals in the latter. Unfortunately, owing to an insistent demand for medical relief, which is what appeals most to the individual in a community with a relatively low standard of living, the funds available were expended in the main on increasing and improving hospitals and dispensaries, and the obvious need for more and yet more of these, associated with a chronic shortage of funds led to the neglect of preventive measures, and particularly of those fundamental but costly ones comprised in the term 'environmental hygiene'.

Relief of sickness and suffering was readily understood and appreciated by the public, while the application of sanitary measures, implying as it did interference in age-long habits, with restrictions which were regarded as irksome and trespassing upon vested interests or religious customs, was opposed on all hands by the people who are as conservative as any in the world. *En passant* it may be noted that the position in India at this time was generally very similar to that in England some hundred years ago.

#### *Separation of preventive and curative departments*

Early in the present century the Secretary of State for India caused the separation of preventive from curative medicine by creating in each presidency and province a separate 'department' for preventive medicine, with an independent budget, and under an officer designated as the 'sanitary commissioner'; the name of the officer was changed in 1922 to the less appropriate one of 'director of public health', and his department was also designated as the 'public health department'. In many provinces the division of duties as between the heads of the departments of curative and preventive medicine was not fully specified, only a broad distinction of curative and preventive medicine being regarded as sufficient. The formation of separate departments for preventive medicine in the various provinces provided a great impetus for this branch of medical work, and far-reaching much-needed reforms were planned. These in many cases were well advanced when the great war (1914-19) called a halt for the time being. After the war the young public health departments again got busy. They found themselves faced with the immense problem of environmental hygiene in a land where, even in towns, safe water supply and sanitary systems of sewage and rubbish disposal were, as a rule, conspicuous by their absence, the housing of the poorer classes was atrocious, and local administration, except in a few outstanding cases, was over-shadowed by vested interests and correspondingly inefficient. In the rural areas, sanitation simply did not exist, soil pollution was general, flies swarmed, malaria and hookworm infection were almost universal, leprosy and tuberculosis were widespread and smallpox, cholera and plague regularly took their periodic tolls uncontrolled by any environmental checks or preventive measures. The provision of properly qualified and trained staff for this work presented a further difficulty. The medical department had its system of hospitals and dispensaries manned by civil surgeons, assistant surgeons, and sub-assistant surgeons. In some provinces the civil surgeons, originally ex-officio district medical and sanitary officers, retained the dual charge, while the public health department was building up a subordinate personnel of sanitary inspectors, epidemic sub-assistant surgeons or health assistants to civil surgeons and later health visitors. All these worked under the director of public health who had one or more assistant directors and other specialists, leaving the provision of the more costly full-time district health officers, until the subordinate personnel had been trained and appointed. Other provinces hastily appointed expensive district sanitary officers, whom in some cases they called medical officers of health, although, owing to the fact that every district already had a district medical officer or the 'civil surgeon' as he is usually called throughout India, their duties were not comparable with those of medical officers of health in England. Further, in the absence of a separate staff of subordinates the work of these new officers was limited to advising. As an exception, the Presidency of Madras succeeded in creating a complete staff of health officers, assistant officers, and sanitary inspectors.

#### *Lack of co-operation between medical and public health departments\**

The question at the present time is the lack of a co-operation and consequently of co-ordination obtaining

in many parts of India between the official medical and public health departments. This is a problem peculiar to India for it does not exist in western countries, nor in the dominions and colonies where the separation of the official health services into 'curative' and 'preventive' has never been effected. To some extent this is due to the unsuitable titles given to the respective departments and still more to their administrative heads. In the presidencies the head of the medical department, as has been remarked already, is known as the 'surgeon-general', a passable application with an historical basis as it is applied to the chief of the United States public health service. In the provinces on the other hand the head of the medical services is known as the 'inspector-general of civil hospitals', an inadequate and misleading designation for one who is the adviser to Government on all matters connected with medical relief, administrator of all public medical institutions, head of the medical services in the province, president of the provincial medical council of registration and medical education and president or chairman of a host of other medical organizations and committees. The designation 'director of public health' is equally inappropriate, since it implies an impossible power and a range of activities much wider than are possible under existing conditions. The two titles together are largely responsible for the confusion of functions pertaining to the two departments and the consequent overlapping, duplication and wastage of their resources. Another factor contributing to this confusion has been the absence of orders laying down the exact policy and scope of work for each department.

It has been asserted that the maintenance of separate departments for medical relief and preventive medicine is an advance upon the English system. Its advocates point out that it enables experts on each side to administer their own subjects. While the specialists in preventive medicine argue that those who have not taken a diploma in public health cannot appreciate the requirements and scope of their work, the clinicians hold that public health personnel is so fully occupied with environmental hygiene that it loses all touch with clinical work and is, therefore, not the proper agency for the administration of medical relief. There is much to be said on both sides. Even in England similar views have been expressed by recognized leaders of the profession. But in actual practice the maintenance of two separate public medical services has not led to satisfactory results in India. So long as the public health department limited its activities to environmental hygiene there was little or no difficulty. This subject offers so vast a field that it could well keep a large department fully occupied for many decades to come. As soon, however, as the separate public health department proceeded to interest itself in individuals rather than communities, overlapping began to appear; this has been most marked in the fields of maternity and child welfare, leprosy and tuberculosis, and even rural medical relief. In regard to midwifery a tendency appears to be developing which, if it is not checked, may lead to a conflict between practising doctors and health visitors and midwives. Already with the peculiar social conditions prevailing in this country medical colleges and schools are finding it increasingly difficult to obtain the requisite number of 'cases' for training. The position in regard to such diseases as leprosy and tuberculosis is anomalous. In one province the inspector-general of civil hospitals is responsible for leprosy work, in another the director of public health. The same applies to tuberculosis.

There is evidence, where it occurs, of a lack of co-operation between the two official departments and of the development of 'exclusion' instead of an *esprit de corps* which can only be destructive in its effects. The situation requires to be met by a close liaison between the two branches, such as, for example, obtains in the Government of India, where the director-general, Indian Medical Service, has the public health commissioner working with him in his office as his principal staff colleague. Such an arrangement not only conduces to a close co-operation, but the distribution of work

\*Jolly, G. G. The need for co-operation in the Medical Health Services of India, with special reference to Maternity and Child Welfare, *I. M. G.*, April 1940.

is facilitated. The urgent necessity for a friendly collaboration between the two departments, if the system is not to break down, is essential, and is recognized by experienced administrative officers of both departments. The Central Advisory Board of Health, established in 1937, should prove a valuable agency in this direction. At its meeting in Madras in January 1939, it passed the following resolution for the establishment of similar provincial boards of health:

'The Board stresses the desirability of establishing in each province and state an advisory board of health with the Minister-in-charge as chairman.'

While in reference to maternity and child welfare it adopted the following resolution:—

'Co-ordination between the medical and public health departments is perhaps more vital in the field of maternity and child welfare than in any other of medical and public health work.'

If a policy of close friendly collaboration obtains between the two departments in the provinces and the relative spheres of each are defined, the existing system will continue to function tolerably well, but, if friendly co-operation that should be sought and loyally observed by colleagues in both the departments, is replaced by a spirit of exclusion, and co-operation is stigmatized as a 'dual control', then the position in which the two departments are in opposition will arise sooner or later and the profession will be divided into two camps. Such a state of affairs will hardly be in the interest of either of the two departments, while the effects of such a controversy is bound to lead to a great deal of suffering for the poor public.

#### *Federal ministry of health*

The best solution of the problem would be the establishment of ministries of health in various provinces modelled on the English system with suitable modifications in regard to the local conditions.

#### *Public health service in Great Britain*

The modern public health service in England is barely a quarter of a century old and, like so many of the English institutions, it arose more by accident than by design. The dissolution of the monasteries left the destitute without visible means of support until the year 1601 when the Elizabethan Poor Law established parish overseers and workhouses—this system remained practically unchanged for over two centuries. Besides relieving destitution, these authorities carried out any measure that was necessary for the public health, such as the control of epidemics, the provision of sewers, or the abatement of sanitary nuisances. In 1834 the Poor Law Amendment Act was passed after a great deal of agitation and following the Report of the Poor Law Commission of 1832. This important bill amalgamated the separate parishes into unions under the control of boards of guardians. District medical officers were appointed to attend to the sick poor, while the infirmaries were built to accommodate paupers who were too ill to remain in the workhouses. In 1835 the Municipal Corporations Act was placed on the statute book to reform the chaotic state of borough government.

Despite all these changes, the state of the public health was never taken very seriously until the cholera epidemics between 1830 and 1854 galvanized the Government into action. Edwin Chadwick, one of the Poor Law commissioners, in his *Survey into the Sanitary Condition of the Labouring Classes of Great Britain*, exposed, not only the insanitary evils of the towns and villages, the hideous legacy of the industrial revolution, but, by showing how closely disease was related to poverty, provided convincing argument in favour of far-reaching reforms. His 'sanitary idea' led to the appointment in 1848 of the General Board of Health, which, after a stormy life, was superseded by the Local Government Board of 1871. In 1872 the country was divided into urban and sanitary districts, and medical officers of health and inspectors of nuisances were appointed for the first time. Credit is due to the authorities of the Liverpool Borough for having had

the vision to appoint a medical officer of health as early as 1847. Then followed the great Public Health Act of 1875 which is the bulwark of all sanitary laws.

A further Municipal Corporation Act was passed in 1882, while the year 1888 was conspicuous for the creation of county councils and county borough councils. From this time onwards there has been an ever-widening stream of health legislation. Statute after statute has swollen the ranks of the public health service to such an extent that to-day there is scarcely any field of human activity in which the health officer does not play a part. Another important landmark, the National Health Insurance Act of 1911, provided the adult manual worker with compulsory insurance against loss of health. The Bill was hotly contested during its passage through Parliament, but it was successfully piloted and passed into law through the efforts of Mr. Lloyd George.

Finally, the creation of a Ministry of Health in 1919 out of the stones of the Local Government Board was the crowning recognition of the importance of health in the nation's life. This wise step was made inevitable by the Great War of 1914-18.

#### *Ministry of health*

The general powers and duties of the Minister in relation to health are defined in the second clause of the *Ministry of Health Act, 1919*, as follows: 'To take all such steps as may be desirable to secure the preparation, effective carrying out and co-ordination of measures conducive to the health of the people, including measures for the prevention and cure of diseases, the avoidance of fraud in connection with alleged remedies therefor, the treatment of physical and mental defects, the treatment and care of the blind, the initiation and direction of research, the collection, preparation, publication and dissemination of information and statistics relating thereto, and the training of persons for health services.'

The Ministry of Health is the chief tribunal for local authorities. Broadly, it engages in the following activities:—

- (1) Public health.
- (2) Local government and local finance.
- (3) Housing and town planning.
- (4) Poor Law administration.
- (5) National health insurance.

'Power', wrote J. S. Mill, 'may be localized, but knowledge to be most useful must be centralized'. Thus, while most executive functions are passed over to the local authorities, the Ministry seeks to maintain proper standards of efficiency amongst them. It supervises their methods of government, especially in regard to the public health matters. Certain too-forward authorities have to be restrained, while other backward ones have to be spurred on to better achievement. One of its most important functions is the control of local expenditure by sanctioning loans only after careful inquiry.

The medical department, under the chief medical officer, is divided up into the following sections:—

- (1) Medical intelligence, infectious diseases, international health, etc.
- (2) Maternity and child welfare.
- (3) Tuberculosis, venereal disease and institutional therapy.
- (4) Nutrition, food and drugs administration, London hospitals, water supplies, etc.
- (5) General practitioner services and insurance.
- (6) Surveys, hospitals, environmental hygiene, and public assistance.
- (7) Medical services, emergency hospital.
- (8) Welsh Board of Health.

Each of these divisions is in charge of a senior medical officer who is responsible to the chief medical officer for the work carried on in his division. Furthermore, regional medical officers are employed to supervise the work of the panel doctors and the pharmaceutical chemists under the National Health Insurance scheme, while other officers are detailed to





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investigate serious epidemics of infectious diseases, outbreaks of food-poisoning, or make surveys of local government areas. These surveys are extremely valuable. Not only do they provide comparative indices to enable the Ministry to issue reports, circulars, and memoranda for the information and guidance of local authorities, but, incidentally, they help the medical officer of health to overcome some of the more difficult problems of administration.

*Proposed Federal Ministry of Health of the Government of India*

In India, a Federal Ministry of Health should be established at the centre to provide the necessary co-operation agency for the provincial local self-government departments, which are at present responsible for the supervision of local bodies and for public health administration in the provinces. This Ministry would also be responsible for the other health functions statutorily conferred on the Central Government by the Government of India Act of 1935. All problems in connection with curative and preventive medicine should be dealt with by one department which should be divided into appropriate sections. The following sections are tentatively suggested for consideration:—

- (1) Prison medical service.
- (2) Port sanitation and quarantine service.
- (3) School medical service.
- (4) Public health including—
  - (a) Medical intelligence, infectious diseases and international health.
  - (b) Nutrition, food and drugs administration including biological products.
  - (c) Environmental hygiene, including housing, water supply, drainage, disposal of waste products.
  - (d) Industrial hygiene.
- (5) Medical relief including—
  - (a) Maternity and child welfare, venereal diseases, tuberculosis, leprosy.
  - (b) General practitioner services with special regard to rural dispensaries.
  - (c) Hospitals.
  - (d) Drug addiction.
  - (e) Health insurance.
- (6) Lunacy.
- (7) Scientific research.

For these purposes, the Ministry should have a highly-trained staff of expert advisors. The director-general, Indian Medical Service, who as surgeon-general with the Government of India most nearly corresponds to the chief medical officer of the Ministry of Health in England, has at present an insignificant number of specialists on his staff. In England though public health administration is established on well-regulated lines, the chief medical officer controls a strong team of workers in each special subject of medical health work, such as maternity and child welfare, tuberculosis, industrial hygiene and so on. In India on the other hand while the conditions are much more complex, and although the necessity for an expansion of the Central Government's technical staff has been repeatedly stressed by the director-general and public health commissioners, the task is left to only two or three officers.

*Materials available*

The materials for the establishment of a Ministry of Health at the centre in India are all available. Thus, though many of the bureaux are under private bodies, their directors act as advisers to the director-general who, as a rule, is connected with such bodies as the chairman of their managing committees. Thus, with the director-general at the top we have roughly:—

- (1) Public health commissioner—Bureau of quarantine, infectious diseases and international health.
- (2) Deputy director-general—Personnel and establishment, medical relief, medical education, etc.
- (3) Assistant director-general (stores)—Medical supplies.

- (4) Maternity and child welfare bureau of the Indian Red Cross Society, with the director-general as its chairman.
- (5) Medical commissioner, Tuberculosis Association of India.  
The director-general is its chairman.
- (6) Medical research.  
The director-general is head of the medical research department and chairman of the Scientific Advisory Board, Indian Research Fund Association, and the public health commissioner its secretary.
- (7) Drugs control.  
The director-general has the director of drug control laboratories on his staff and is also the chairman of the advisory board for drug control.
- (8) Nutrition.  
The Director of Nutrition Research Institute, the officer in charge of the Nutrition Enquiries of the Indian Research Fund Association, acts as the expert adviser to the director-general.
- (9) Malaria.  
The Director of the Malaria Institute of India acts as the adviser to the director-general.

Other loose connections exist or are being forged, e.g., leprosy through B.E.L.R.A.; food standards through a standing committee to be set up by the Advisory Board of Health, while new connections have to be established with the railway medical services and prison medical services, school medical services, etc.

The provision of a suitable staff of experts must devolve on the Federal Government and cannot be relegated to the provinces. The Royal Commission on Health in Australia (1925) emphasized that, as 'the success of health administration is more dependent on the personality and capability of the officers directing it than on any other single factor, the Commonwealth Government should be responsible for the maintenance of highly trained experts to advise and help local authorities when desired by State Health Administrations'. If such an arrangement suits Australia, I agree with Raja (1937) that a similar plan might be equally successful in India. Moreover, a carefully selected central staff would, to some extent, avoid the duplication of posts of highly specialized men in the component States of the Federation, and the position and prestige of the Federal administration should enable it to attract the proper type of men.\*

The selection of the Federal chief medical officer should be dependent on his being both medical and public health experience, and deputies must be given a chance to familiarize themselves with the wide range of the curative, preventive and constructive aspects of medicine.

*Public health organization in the Provinces*

Each province should have a chief medical officer responsible to the Minister of Health of the province for the administration of the whole of the medical subject with a number of deputies in charge of the various departments, e.g., prisons, schools, medical and public health problems. The deputies should be given a chance to work in different departments, so that the chief medical officer of the future would have men available with first-hand experience of individual and environmental hygiene, while regional medical officers should be appointed to look after various areas or zones.

A provincial board of health under the chairmanship of the Minister of Health should be constituted in each province. The members should be drawn from the medical and public health specialists and suitable persons should be co-opted for different problems. The help of the revenue, education and public works departments would be needed to shape the health

\* Raja, K. C. K. E. 'A plea for a forward Public Health Policy in India'. *Indian Med. Gaz.*, 1937, Vol. LXXII, p. 428.

policy of the province. Suitable persons may be constituted into *ad hoc* committees to tackle important problems of general and local interest, while the co-operation and advice of the specialists on the staff of the Federal Ministry of Health should be available to the provincial governments in connection with problems of an all-India nature.

In the districts, district health committees should be formed for the same purpose. These should be presided over by the collector of the district or the president of the district board; the co-operation of both agencies is essential, and this alone will make it possible for these committees to work efficiently.

So far as the rural population is concerned, medical men engaged in curative work should be able to undertake public health duties as well. Their education and training should be of such a nature as to enable them to do so without difficulty. The doctors engaged in combating epidemic diseases should be expected to undertake public health work when not dealing with outbreaks of infectious diseases. The rural doctor, who is the final link between the health services in this country and the people, can also impart elementary health education to patients in connection with immediate surroundings. Such instruction would be much more effective than general lectures and demonstrations to large audiences.

#### Conclusions

To sum up the views expressed above, I consider that, under the conditions prevailing in India at present, the State is essentially responsible for preventive and curative medicine. Curative medicine forms an integral part of the public health services of a country inasmuch as very often the sick man is the source of infection and no constructive medicine is possible unless the population is rendered free from disease by treating the individuals. Again according to the newer conceptions of a State, it is necessary that disablement whether temporary or permanent should be cut down to the barest minimum through intensive use of curative medicine. Moreover, it is through curative medicine alone that it is possible to win the confidence of the public in a country like India

and bring home to people the advantage accruing both from preventive and constructive medicine.

Starting from the bottom, I consider that to meet the requirements of public health of the population there should be combined establishment which should form the basis of preventive, curative and constructive medicine in each village. This should be linked up with a more organized central agency discharging these combined duties and catering for a convenient sized population, the bulk of which will depend upon various factors, such as communications, incidence of disease, etc. These primary organized centres will be supervised and assisted by a district centre in which there should be a specialized staff for the main medical subjects. These district centres in turn should be in touch with a larger provincial organization in which the staff consisting of specialists in various branches of medical science should work under a senior and experienced medical man. This latter should constitute the administrative head of the medical service in the province under the provincial Ministry of Public Health. He should have a thorough training in the methods of public health administration, community health organization, constructive medicine, etc. The staff of the provincial organization should further be large enough to be utilized for medical and public health training, both undergraduate and post-graduate.

The activities of the health organization in different provinces should be co-ordinated by a more elaborate and efficient Federal, or all-India, organization working under the Federal Ministry of Health. The administrative head should be an officer with wide experience of preventive, curative and constructive medicine, and have on his staff expert advisers in as many of the important branches of medicine as possible. With the advice and help of these advisers, it should be his duty to deal with and co-ordinate the problems of public health which concern the country as a whole. Curative and preventive medicine must work as one single whole; to let them work separately in watertight compartments is sure to lead to confusion, while only an organization of the nature detailed above will be able to deal successfully with the multifarious problems of public health in this vast country.

## Medical News

### TUBERCULOSIS WORKERS' CONFERENCE

THE second Tuberculosis Workers' Conference was held in New Delhi from November 18th to 21st and was attended by about 90 delegates including workers from tuberculosis institutions, representatives from public health departments of Provinces and States, of local government authorities, of the army and of the railway.

The first morning of the conference was presided over by Her Excellency the Marchioness of Linlithgow, President of the Tuberculosis Association of India. In requesting Her Excellency to open the conference, General Jolly, chairman of the Association, spoke of the personal interest and the detailed attention which Her Excellency paid to all the affairs of the Association matched by an equally detailed knowledge of the subject and of the various administrative difficulties that had to be faced in an organized effort to combat the disease. He knew that he was expressing the feelings of every tuberculosis worker throughout India, whether lay or medical, when he said that they were filled with gladness at the thought that circumstances had made it possible for Her Excellency to remain with them another year and that they would continue to enjoy her inspiration and guidance for that period.

Lady Linlithgow, in opening the conference, said:

'Once again I have the pleasure of welcoming you to a conference of tuberculosis workers. The value of the last one held just a year ago is evinced by the recently published report. The advocacy of the

different treatments by various eminent doctors, the results obtained, the statistics kept, all tend to throw light on the treatment of the disease and to determine the effect of climatic influences in conjunction with treatment.

The very necessary subject of tuberculosis surveys has been examined by a sub-committee of the Indian Research Fund Association under General Jolly and they have drawn up a comprehensive report which is to be discussed. This gives me great satisfaction, as without surveys it seems to me impossible to get a true picture of the situation, and conjecture is most unsatisfactory when dealing with a problem of this magnitude.

We shall have the great pleasure of showing you the Model Clinic in Delhi which was started after the conference last year and which is almost completed. This has fulfilled one of my dreams.

Another will shortly be fulfilled in the form of the Kasauli Sanatorium and Teaching School. The Government of India have generously made this possible by granting the necessary expenditure subject to ratification by the Assembly. Some of you may remember that I spoke last year about the possibility of constructing an institution in the Simla Hills embracing a sanatorium with facilities for training. That institution will now be available. To those of you who do not know, I would like to tell of the Pasteur Institute's generosity. They offered me their buildings and property and accompanied that offer with a suggestion of an annual

grant which we hope will materialize. A certain amount of reconstruction will have to be undertaken and roads must be improved. Plans are now being drawn up and we hope to put the work in hand very shortly. Provision for a hundred beds is being made with room for expansion and we hope that support will come from all parts of India as we wish it to be an all-India institution. According to the amount given, beds will be reserved for that province or state, and doctors can come from any part of India for training. I do earnestly ask any of you who may come to hear of plans for constructing small buildings with money which is not adequate for the purpose, to turn their attention to an annual grant for Kasauli, with a corresponding number of beds.

You will I know be interested in Doctor Frimodt-Møller's sub-committee's report on the classification of pulmonary tuberculosis which is to be presented to the conference.

A special feature of the discussions this year is on the subject of environment in relation to tuberculosis, an aspect which so far has received very little attention and which is of such great importance. I hope very much that the whole conference will benefit from a frank discussion and that the outcome will be a deeper knowledge of the necessity of suitable environment for successful treatment of the disease.

After the opening function the conference was in session for four days, during which eleven papers were read, each followed by a full discussion.

[A short résumé of the papers and the discussion were received too late for inclusion in the present number. They will appear in the February number.]

#### MEDICAL STORES SUPPLIES IN INDIA

MANY problems affecting medical supplies to the Army were considered at the third meeting of the Drugs Supplies Committee, now called the Medical Stores Supplies Committee, held recently under the chairmanship of Lieut.-General G. G. Jolly, I.M.S., Director-General, Indian Medical Service.

Samples were shown of emetine hydrochloride, apomorphine hydrochloride, acriflavine and dried blood plasma made in India under schemes of investigation fostered by this committee in close liaison with the Board of Scientific and Industrial Research of the Commerce Department.

To combat shock through loss of blood, blood transfusion is largely used in modern medicine. Such blood is difficult to obtain in quantity for the treatment of the wounded in the field and other methods are being carefully considered. One of the most successful and promising of these methods is the use of dried blood plasma. Blood to which sodium citrate has been added to prevent coagulation is allowed to settle and the clear liquid drained off. This liquid is dried *in vacuo* to a granular powder and packed aseptically in containers. Before use it is made into a solution with sterile water and given to the patient in the same manner as a blood transfusion. A sample of dried blood plasma, the first to be made in India, was shown to the committee which discussed the question of its manufacture in India.

The production of emetine hydrochloride which is still required for the treatment of amoebic dysentery is dependent upon the growth of *ipecaquanha*. This drug grows wild in the forests of South America but is more and more difficult to obtain the further the forests have to be penetrated. *Ipecaquanha* however has been demonstrated to grow well in Mungpoo, Bengal, and the question of encouraging its cultivation in India is under consideration.

Much progress has recently been made in Travancore, Bombay and Madras in the development of fish-liver oil schemes for supplying India with substitutes for cod-liver oil. The essential factor in these oils is their content of vitamin A and vitamin D. As the shark-liver oil has ten times the vitamin A content of cod-liver oil it forms a valuable source of vitamin A. This oil however is lacking in vitamin D so that it is necessary

to add this vitamin to it. Vitamin D, a complex chemical substance, has now for the first time been made in India at the Indian Institute of Science.

#### PROGRESS OF INDIGENOUS MANUFACTURE

OWING to the extended production of drugs in India as many as 92 various drugs have been taken off the import list.

The manufacture in India of suitable disinfectants has been taken up by the Medical Stores Supplies Committee under the chairmanship of Lieut.-General G. G. Jolly, I.M.S., Director-General, Indian Medical Service. Attempts are being made to produce a complex chlorine compound hitherto imported which is essential for the manufacture of many non-irritating efficient disinfectants which are now so largely used. Acriflavine is also an important disinfectant, particularly in war time, and its manufacture in India from locally produced materials is under investigation. Samples have already been produced in an Indian laboratory.

Troops in the field deprived of fresh fruit or vegetables develop scurvy. To prevent this disease, tablets of vitamin C are made up and India's most concentrated form of vitamin C is 'amla'. Amla berries are collected in the Nilgiris under the supervision of the Director, Nutrition Laboratories, Coonoor, dried and made into tablets of suitable size. The committee is now contemplating the production of a more concentrated form of vitamin C.

Substitutes for corks are being considered. These have become expensive and difficult to obtain owing to the war. Samples of wooden corks made by the Forest Research Institute, Dehra Dun, having two circular slots to increase resilience are being examined and are to be tried out on a large scale. Bottles with threaded glass necks and metal caps as well as bottles with crown corks are also considered as possible substitutes for bottles with corks.

#### BOMBAY MEDICAL COUNCIL

EXTRACTS from the proceedings of the Meeting of the Bombay Medical Council held on the 16th September, 1940.

At the outset, the registrar intimated that General Buckley, the president of the Council, regretted his inability to attend the Council meeting. In his unavoidable absence, therefore, Colonel Bhatia was voted to the Chair unanimously.

Government Notifications regarding the nomination of Dr. George Coelho, M.R.C.P., and the election of Dr. S. B. Gadgil, F.R.C.S., as members of the Council were read by the registrar. The chairman, Colonel Bhatia, then introduced Dr. Coelho and Dr. Gadgil to the meeting.

The Council passed a resolution by a majority expressing the opinion that in the absence of a common Indian language, medical education of the western type should be imparted through English as is done at present, for the time being. An amendment to the original resolution seeking postponement of the consideration of the question for the next meeting of the Council was declared lost.

It was decided to restore to the Bombay Medical Register the name of Dr. D. S. Pathre, M.B., B.S., removed under section 9 of the Bombay Medical Act, 1912, on 8th November, 1937, accepting the recommendation of the Executive Committee on that behalf.

In view of the impending retirement of General Buckley, the president of the Council, Colonel Bhatia, the Chairman, paid a glowing tribute to the career and services of General Buckley and a resolution moved from the Chair placing on record the appreciation of the Council of the valuable services rendered by General Buckley as President of this Council to the medical profession in general and to this Council in particular for nearly four years was passed unanimously.

## Current Topics

### The Treatment of Habitual Constipation

By F. S. LANGMEAD, M.D., F.R.C.P.

(From the *Medical Press and Circular*, Vol. CCIII, 17th January, 1940, p. 45)

CONSTIPATION is a relative term, for whilst some whose bowels are opened only two or three times a week are little, if at all, the worse for their infrequency, others if they miss one day suffer from headache, depression, sleeplessness, irritability and other disturbing symptoms. It is usual, however, to regard a patient as constipated in whom the food takes longer than about 48 hours to travel the length of the alimentary tract—a period which may be measured by the administration of charcoal.

In this short article no attempt will be made to consider the treatment of constipation due to some recognized organic disease of the alimentary tract or some general disorder such as myxœdema, but it will be limited to 'habitual' constipation—an apt term, for in its causation and treatment habit plays an important, indeed dominant, part. Such habitual constipation may begin in early infancy and persist, if untreated or treated late, throughout life. The prevalence of constipation is probably one of the prices which the community has to pay for its artificial order of life, for it is difficult to believe that under quite natural conditions constipation would be the bugbear that it is to-day. A community living mostly in the open, hunting for its food, eating largely of vegetables, and unhampered by the observances of modern social behaviour, would be unlikely to be troubled by constipation. Since a return to the state of primitive man is impracticable, our problem is to determine how it may be avoided and combated under the artificial conditions which foster it.

It is customary to consider constipation under two headings, that due to sluggish passage through the colon or 'colonic stasis' and that due to delay in the rectum or 'dyschezia'. Of these the latter is by far the most important and common; indeed, the more closely the subject is studied the more subsidiary is the place which colonic stasis is found to occupy in the causation of habitual constipation. In the ordinary case faeces are allowed to accumulate in the rectum until the normal reflex response is weakened or lost. This engenders further accumulation of faeces. Such a vicious circle has often been in control for a long time, perhaps for years, before advice is sought; the habit of daily evacuation has been lost and replaced by irregular defaecation secured by various adventitious aids, so that our effort to assist the patient to regain the normal reflex—which should be our main aim in treatment—may need to be prolonged, can only be useful if assisted by the full co-operation of the patient and, it must be confessed, may fail.

**Prevention.**—Despite the difficulties incidental to modern life, much may be done to prevent constipation. The baby from the first weeks of life should be trained to defæcate regularly, by being held over a receptacle at definite times. A suitable time is after a meal, and the reflex may be further 'conditioned' by approximating it to some event incidental to infant hygiene, such as bathing or exercise. Later the child should be trained to accept defæcation as a regular duty after a breakfast, thus taking advantage of the gastrocolic reflex; and also at all possible times to defæcate whenever the rectal stimulus is felt. It is obvious if this advice is to be followed that schools should provide ample lavatory accommodation. Its paucity, assisted perhaps by a false sense of modesty, may replace habitual defæcation by habitual constipation. The habit of giving purgatives to infants should be eschewed equally with that of administering a weekly purge to older children, which, though less prevalent

than in Victorian days, is still far too common, especially among the hospital class. Castor oil, especially, should be taboo, for after the irritant effect on the intestine has subsided it is followed regularly by constipation. Abuse of purgatives in general has played a prominent part in causing much of the constipation that the doctor is called upon to treat.

**Curative.**—It is not feasible to lay down a routine method of treatment for habitual constipation. Circumstances alter cases—and their treatment. It is futile to tell a patient with a rectum packed with dry faeces to take more exercise or eat brown bread; and it is harmful to treat all cases, regardless of their degree, by administering drastic purges. In the following brief summary of treatment an endeavour will be made to consider various lines of treatment *serialim*, beginning with those which alone may suffice for milder cases and which play a part in the treatment of all. The problem is not 'What shall I give this patient to make his bowels open?' but rather 'How shall I treat this patient so that he opens his bowels regularly?'

(a) **Habit.**—The aim of curative treatment should be to regain the normal rectal reflex, just as in preventive treatment it should be trained, if necessary, and retained when present. The patient should be exhorted to attempt defæcation regularly after breakfast and to be prepared to spend some time in the attempt. A hurried visit to the lavatory *en route* to catching a train or bus does not suffice. The w.c. should be warm, the seat comfortable, and at such a height that the thighs are somewhat flexed.

(b) **Exercise.**—The general tone of the patient should, if possible, be improved by exercise, preferably in the open air. A round of golf before breakfast or a ride, walk or run, according to age and circumstances, may be attended by great improvement, as may also the 'daily dozen' when other exercise is not procurable. Exercises directed towards increasing the tone of the abdominal muscles are, of course, particularly suitable.

(c) **Diet.**—Careful inquiry should be made concerning the patient's habits with regard to food and drink. Irregular and snatched meals should be avoided if possible. It may be found, especially in the case of women, that meals are ordinarily taken without fluid, or that tea is drunk, strong and often, by itself—both habits which favour the disorder. Fruits, especially prunes and figs, vegetables, coarse porridge, brown bread and other foods which provide what the Americans dub 'roughage' are well recognized as being beneficial in moderate cases, but do not alone suffice in those that are more severe. If taken inordinately they may accentuate the trouble in a case in which the bowel is already loaded with scybala. They are particularly indicated in cases of so-called 'greedy colon', where absorption is excessive and the rapacious colon leaves little residuum to stimulate reflex action. Honey, manna and golden syrup are useful by virtue of a slight laxative action. In the case of infants, maltose may replace lactose or cod-liver oil with maltine may help. An early morning glass of hot water or cup of weak tea may be attended by success.

(d) **Lubricants.**—When hygienic and dietetic management are ineffective alone, lubricants are preferable to purgatives and may suffice. Such are paraffin or petroleum emulsion, or in the case of infants, olive oil. The well-known disadvantage of paraffin that it may escape unaware by the anus when the patient assumes the erect position is less troublesome if petroleum emulsion be used. These substances have a large field of usefulness, for if taken in sufficient amount, they do at least ensure that the motion is soft and reduce the likelihood of straining at stool—a dangerous practice to many, notably to patients with myocardial insufficiency or high blood pressure.

(e) **Purgatives.**—These should be avoided whenever possible and, if employed, always with the hope that they may happily be abandoned when other measures have had time to cause improvement. To tabulate a list of purgatives and to extol the particular virtues of each is beyond the scope of this article. Some may



be pleasant and effective to some patients, whilst definitely toxic to others. I can only suggest a few general rules, which, in my view, should govern their use.

(i) Choose a purgative which acts upon the large bowel rather than upon the small. 'Take care of the large bowel and the small will take care of itself' is a sound axiom. Such purgatives are saline, senna, aloes, sulphur and cascara—all of proved value. For the constipated dyspeptic, rhubarb, whatever its action may be, is advantageous, as is testified by the countless takers of the ubiquitous rhubarb and soda mixture. Calomel in my view, is unsuitable for the treatment of habitual constipation, useful as it may be for purging in other cases, where elimination of indigestible or decomposing food is required. It hurries the contents of the small intestine into the large and in too many instances causes severe colic. The same may be said of castor oil—a very useful eliminative but undesirable for habitual constipation. Purgatives containing vitamins, intestinal glandular extracts or bile salts have become popular for they often produce a satisfactory result without colic or discomfort.

(ii) If purgatives be necessary they should be given regularly and not each time that the bowels have not been opened for several days.

(iii) They should be given in doses large enough and often enough to ensure daily evacuation. When this has been attained it will often be possible, other forms of treatment being used, gradually to reduce first the dose and secondly the frequency until they can be abandoned.

(f) *Enemata*.—In some cases constipation has reached the pitch where the rectum and colon are loaded with hard and dry faeces and where no treatment is likely to be effective until the bowel has been cleared of this burden from below by the use of enemata. Lavage with hot water or a simple enema

may be enough or recourse may be had to glycerine or warm olive oil. The effect of an enema may be enhanced by the use of a suppository, such as anusol, introduced at night, so that it may gradually permeate and soften the faeces during sleep. It may render the enema unnecessary.

Enemata should be regarded only as temporary measures to be abandoned as soon as possible, otherwise the patient may embark upon what proves to be an enema life. Especially advocated in children, but sometimes equally useful in adults is the soap cone, which may prove as active in evoking a colon response as an enema.

(g) *Massage*.—Though this is mentioned last it is by no means least. In a really intractable case when other methods have been tried over long periods, I have found that the addition of abdominal massage often meets with success. The effect, of course, is not immediate, in such cases, it should be persisted in.

I will conclude by mentioning a variety of constipation in infants which often goes unrecognized and is intractable to all ordinary forms of treatment—namely, anal spasm. In spite of active treatment the bowel fails to act regularly. If lubricants have been given, the infrequent motions may be found to be soft and would appear to give no cause for difficulty. The abdomen may become distended with flatus, the child suffering from colic and obviously in great discomfort. I have known abdominal operation for obstruction seriously considered in such a case. The diagnosis is made by rectal examination when the finger meets with a tense but yielding sphincter, the forcing of which leads to the passage of faeces and flatus and to prompt relief. The method of diagnosis embraces the treatment, for thereafter if the motions be kept soft, there is usually no further trouble. Other cases may require more prolonged or repeated stretching of the sphincter.

## Reviews

**CLINICAL PRACTICE IN INFECTIOUS DISEASES: FOR STUDENTS, PRACTITIONERS, AND MEDICAL OFFICERS.**—By E. H. R. Harries, M.D. (Lond.), M.R.C.P., D.P.H., and M. Mitman, M.D. (Lond.), M.R.C.P., D.P.H., D.M.R.E. 1940. E. and S. Livingstone, Edinburgh. Pp. xii plus 468. Illustrated. Price, 17s. 6d.; postage, 7d.

INFECTIOUS diseases play a very important part in the daily round of the general practitioner in temperate climates and to a less extent in the tropics. Nevertheless the attitude of the medical student is rather that 'fevers' is a dull subject that has to be 'got over' somehow. This was certainly the reviewer's opinion and this attitude was engendered by the fact that the process of 'doing fevers' entailed a dreary journey to a suburb where he was shown rashes which, like one's friends' wireless reception or gardens, were always 'so much better yesterday'. He also had very dull books in which to read up the subject for his examination. This new book appears to have some life in it. The introductory chapters are good and are designed to stimulate an intelligent interest in the subject; they are on such subjects as infection and resistance, hypersensitiveness, allergy, anaphylaxis, serum reactions, transmission of infectious diseases, diagnosis, diet in infectious disease, etc.

The chapters on the common exanthemata of temperate climates, which are also common in hill stations in India, only occupy about a third of the book, and a good deal of space is given to diseases such as cerebro-spinal meningitis, dysentery, typhoid, undulant fever which are even more common in tropical than in temperate countries. The teaching is sound and up-to-date.

The illustrations are practical and the authors have faced the fact that most coloured plates of skin diseases are merely misleading.

We have a minor criticism: References have a minor place in a book of this kind but why be self-conscious about their absence or scarcity, and trot out the threadbare excuse that their inclusion only confuses the student, or words to that effect? Why assume that only students will read your book? Well-chosen references add very much to the value of a book; it is unnecessary to overload a book or paper with references in the worst American style—a bad practice which is creeping into medical publications in India. A reasonable excuse is that it takes a long time to check every statement associated with a reference and, as British writers don't usually relegate this work to secretaries, it would hold the book up for possibly some months. A second criticism is that sleeping sickness is not transmitted by the tick; this surprising statement appears in a table and is probably a misprint.

Otherwise the book is an excellent one which we can strongly recommend to students, practitioners, and teachers in this country.

**MODERN DIETARY TREATMENT.**—By Margery Abrahams, M.A. (Oxon.), M.Sc. (Columbia University), and E. M. Widdowson, B.Sc., Ph.D. (Lond.). Second Edition. 1940. Baillière, Tindall and Cox, London. Pp. xii plus 401. Price, 10s. 6d.

We reviewed the first edition of this book only three years ago and commented very favourably on it.

Our opinion seems to have been shared by others, for a second edition has been demanded within a very short time. The present edition is slightly enlarged



and has been revised throughout, as more information on the composition of food substances is now available. A few recent advances in medical treatment are reflected in the addition of diets suitable for patients on protamine zinc insulin, of low potassium diets for Addison's disease, and of low phosphorus diets for hypoparathyroidism; a recent retreat has been signalized by the exclusion of the now-obsolete ketogenic diet.

The book is an extremely practical one with a strictly scientific basis. We still think that the title is misleading and that 'Dietary in Modern Treatment' or some other variation not used already, would be better than the present one; it is not a book on treatment *by* dietary as the name implies. Its very practical nature is typified by the short section on Jewish dietary, and the consoling statement that it is against the tenets of the Jewish religion to fast on the day of atonement *against* the doctors advice.

It is a book that will be very useful in India, despite the fact that it is not written primarily for Indian patients.

**APPLIED PHARMACOLOGY.**—By A. J. Clark, M.C., M.D., F.R.C.P., F.R.S. Seventh Edition. 1940. J. and A. Churchill Limited, London. Pp. x plus 672, with 92 illustrations. Price, 21s.

It is three years since the sixth edition of this 'contemporary classic' was issued and many things have happened in the pharmacological field during these three years. The author apologises in the preface for the inadequacy of the treatment of the new subjects; the chapter on the sulphonamide group is admittedly short, but it provides an excellent outline, and, as the scene is changing so rapidly, detail would run the danger of becoming out of date before it was printed.

The chapter on endocrines and vitamins have again been completely revised although they were only written for the last edition. A new and useful chapter on the pharmacology of the hæmopoietic system has been included in this edition. In this chapter the author gives a classification of the anæmias, on modern lines, but most emphasis is laid on the treatment of the two main types by iron and liver extract, respectively. The chapter provides a good account of the subject, though the statement that 'a total daily dose of 3 gr. of ferrous sulphate in this form [tablet] is effective in microcytic anæmia' is misleading, as there is no indication that he is discussing minimum dosage; a dose of 3 to 6 times this amount is usually given. One is a little disappointed that there is not more about iron metabolism, for a great deal of work has been done on this subject, and, though we have still much to learn, a few definite facts regarding iron absorption, retention, utilization, and excretion have been established.

The present requirements are not lost sight of and important information will be found in the chapter on disinfection of wounds. With reference to sulphonamides the author says that 'these reduce the ceiling of air pilots', a very useful thing to be remembered, but why not 'lower the ceiling' and maintain this very descriptive metaphor?

To produce this book at all under present conditions is very creditable and we do not see much evidence of either the 'hurry' or 'the special difficulties' to which the author refers in his preface. The present edition will certainly enhance the established reputation of this book.

**ELECTROCARDIOGRAPHIC PATTERNS: THEIR DIAGNOSTIC AND CLINICAL SIGNIFICANCE.**—By A. R. Barnes, M.D. 1940. Charles C. Thomas, Springfield, Illinois. Pp. 193, with 94 illustrations. Obtainable from Baillière, Tindall and Cox, London. Price, 27s. 6d.

In the recent years, study of the various electrocardiographic patterns associated with myocardial disease and the introduction of chest leads has opened up new possibilities of accurate estimation of cardiac disorders. This book, written by one whose contribution to recent knowledge of the subject is considerable,

describes the electrocardiographic patterns in different varieties of heart disease.

The book consists of nine chapters. A chapter has been allotted to the discussion of the relation of the distribution of the coronary arteries to acute myocardial infarction. The other chapters deal with the electrocardiographic patterns in myocardial infarction, in predominant ventricular strain, in acute and chronic right ventricular strain, and in pericarditis, the effect of certain drugs, metabolic disorders and infections on the electrocardiogram. The last chapter is devoted to a detailed consideration of the subject of precordial leads. Each chapter is well illustrated with numerous tracings and the mode of presentation of the subject is admirable. There are numerous short case notes with series of electrocardiograms to illustrate the various patterns encountered in different types of cardiac disease.

The printing, get-up and illustrations are excellent. The book will prove to be of great interest to the cardiologists.

P. C. S. G.

**BLOOD GROUPS AND BLOOD TRANSFUSION.**—By Alexander S. Wiener, A.B., M.D. Second Edition. 1939. Baillière, Tindall and Cox, London. Pp. xvii plus 306, with 52 illustrations. Price, 27s. 6d.

The first edition of this book, in 1935, became the standard work on the subject, in English. The present edition, in which additional matter covering 86 pages has been embodied, is welcome and will certainly maintain the reputation of the first edition.

With a view to increasing further the utility of this useful book three major suggestions are offered for the next edition: (i) Mathematics may be reduced. (ii) More macroscopic methods of hæmagglutination may be described. (iii) In introducing genetics the traditional cryptic symbolism which uses T for the DOMINANT character TALL and t for the recessive character dwarf may be modified. T for TALL and d for dwarf are the most obvious symbols. The letter t for dwarf is unnecessarily cryptic and an embarrassment in the consciousness in following the products of the allelomorphs.

Then there are three minor points: (i) The 'indirect evidence as to the duration of life of the red blood corpuscles', on page 55, is really direct evidence. (ii) The age of the transfused corpuscle of the same group, but not of the same type, is now known to be 100 days instead of 'seven weeks'. (iii) In table 5, O should be above A.

The paper, printing and binding are good. No printer's errors arrest attention. The price perhaps could be lower.

S. D. S. G.

**INTRODUCTION TO CARBOHYDRATE BIO-CHEMISTRY.**—By D. J. Bell, B.Sc. (Glas.), M.A. (Camb.), Ph.D. (St. Andrews), A.I.C. 1940. University Tutorial Press Limited, London (Clifton House, Euston Road, N.W.1). Pp. viii plus 112. Price, 3s. 6d. Obtainable from Oxford University Press, Bombay and Calcutta

THIS handy little volume is intended particularly for students of biochemistry and the aspects of knowledge which a student has to seek from diverse sources are correlated in this volume. It begins with a brief account of photo-synthesis which is followed by the recent views about the structure of monosaccharides, disaccharides and polysaccharides. It then discusses the biochemical events which result in the liberation of energy in living cells, as in alcoholic fermentation, or in animal tissues, as in muscle glycolysis. The recent discoveries on the hydrolysis and synthesis of sugars and polysaccharides by means of enzymes, the nature of uronic acids, plant glycosides, nucleotides and related substances, the polysaccharides of bacteria, moulds and yeasts and the decomposition of carbohydrates by bacteria, are all briefly discussed in turn. For the benefit of the more advanced students and for the assistance of pure chemists and biologists the author has included the references to the more interesting and

fundamental original papers and to general reading. Written by one who had several years of close touch with modern research in the field, the book should be welcome, not only by biochemists but also by other men of science who desire to possess an up-to-date knowledge of this subject without hunting the larger and more costly textbooks on biochemistry which soon become out of date.

S. G.

**ADVICE TO THE EXPECTANT MOTHER ON THE CARE OF HER HEALTH AND THAT OF HER CHILD.**—By F. J. Browne, M.D., D.Sc., F.R.C.S.E., F.R.C.O.G. Fifth Edition. 1940. E. and S. Livingstone, Edinburgh. Pp. 48. Price, 6d.; postage, 2d.

It is a clear sign of the times that the first chapter of this admirable little book is devoted to the importance of antenatal care and the chief abnormalities against which it is designed to protect the expectant mother. The text of 46 pages is throughout simple, clear and never wordy. The chapters on the common disorders of pregnancy and on diet deserve special mention.

Although the book is intended for the expectant mother it contains much to recommend it to the nurse, midwife and health visitor, and indeed the young general practitioner may find in it solutions of his early problems, presented in a simple and compact form.

L. S. G.

## Abstracts from Reports

### ANNUAL REPORT OF THE HEALTH DEPARTMENT OF THE MUNICIPALITY OF SINGAPORE FOR THE YEAR 1939

APART from one case of smallpox, we enjoyed another year of complete freedom from the dangerous infectious diseases, smallpox, cholera and plague.

The case of smallpox was in a young Chinese girl who had lived at 50, New Market Road for at least five months prior to the date of onset of the disease. Though exhaustive enquiries were made the source of the infection could not be traced, and no connection with any previous case could be established.

Except for the decrease in the incidence of typhoid, and the increase in the number of diphtheria cases notified, nothing calls for special comment.

It might, however, be well to point out that the increased incidence of the typhus-like diseases is probably due to improved diagnosis rather than to a true increased incidence in these diseases. Weil-Felix reactions are now carried out in all suspicious cases, and some positive reactions have been obtained which have enabled a diagnosis to be made which otherwise would probably have been missed.

Under the heading of typhus in the returns are included rural-type tropical typhus, Japanese river fever and urban-type tropical typhus. Epidemiological evidence has been obtained that *T. akamushi* and *T. deliensis* are the vectors of rural-type tropical typhus and Japanese river fever which are now considered to be the one disease. There is laboratory evidence that the virus of the urban type can be transmitted by the rat flea. Louse-borne typhus has not been seen in Singapore or Malaya.

With regard to leprosy, it is possible that the increased number of cases notified is due to earlier and improved diagnosis, and to patients coming forward more readily for advice and treatment. With the relaxation of the conditions, under which cases may now be treated in their homes, under the new leper rules which came into force during the year, there is probably less inducement to conceal cases of this disease.

The usual routine rat-trapping laid down by the International Sanitary Convention was carried on throughout the year. Three thousand two hundred and eighty-three rats, trapped in the town and port areas, were examined in the laboratory. None was plague-infected. The flea index remained low, being only 1.08 per live rat against 1.06 in the previous year.

It may be of interest to record that four deaths from leptospirosis (Weil's disease) and two from encephalitis lethargica were certified during the year.

## Correspondence

### ROLE OF CALCIUM GLUCONATE AND IODINE IN WHOOPING COUGH

To the Editor, THE INDIAN MEDICAL GAZETTE

SIR,—In an Indian family, four children were suffering from whooping cough. Two were girls 9 and 3 years old and two were boys 5 and 2 years old. On account of getting fits of whooping cough at very short intervals, the conjunctivæ of their eyes were congested and none of them could retain food or sometimes even water. The result of this malady was that they were getting thinner and weaker. All different medicines by mouth were tried but they could not get any relief. As a last resort it was thought to give injection of 2 c.cm. 10 per cent solution calcium gluconate c. iodine. Each child was given 2 c.cm. intramuscularly. After twenty-four hours it was observed that each of them could retain one meal during 24 hours. This slight improvement led me to try a further injection of 2 c.cm. each on the third day. To my great satisfaction I found that the fits of whooping cough were greatly reduced in number and the power of retention was markedly improved. Four more injections were given after an interval of four days. In all, six injections were given to each of them.

The result of the six injections was that they made an uneventful recovery and at the end of the treatment they were looking brighter, happier, and greatly improved in health.

R. N. MISRA, M.B., B.S.

9A, VIVEKANANDA ROAD,  
CALCUTTA.

## Service Notes

### APPOINTMENTS AND TRANSFERS

ON recall to military duty Lieutenant-Colonel G. A. Khan, Superintendent, Borstal Institution, Lahore, made over charge of his duties to a non-I.M.S. officer on the afternoon of the 14th October, 1940.

Lieutenant-Colonel M. P. Atkinson, an Agency Surgeon, is employed as Chief Medical Officer, Western India States Agency, and Residency Surgeon, Rajkot, with effect from the forenoon of the 23rd October, 1940.

Major G. W. Miller is appointed to officiate as Deputy Public Health Commissioner with the Government of India during Major C. K. Lakshmanan's absence on leave.

On recall to military duty Captain C. F. Garfit, Civil Surgeon, Murree, made over charge of civil medical duties on the 2nd November, 1940.

Captain H. B. Wright is attached as an additional officer to the Medical Store Depot, Lahore Cantonment, with effect from the forenoon of the 4th November, 1940, until further orders.

On recall to military duty Captain H. H. Mahmud, Superintendent, Central Jail, Lahore, made over charge

of his duties to a non-I.M.S. officer on the afternoon of the 19th November, 1940.

The following appointments are made:—

INDIAN LAND FORCES  
(Emergency Commission)

*To be Captain (on probation)*

Shreedhar Damodar Dalal. Dated 23rd September, 1940, with seniority from 23rd September, 1936.

*To be Lieutenants (on probation)*

23rd September, 1940

Nripendra Mohan Khan Bhaduri.  
Muhammad Sunawar Ali Laskor.  
Iswar Chandra Misra.  
Harishchandra Paul.  
Nawabzada Ali Ahmad Khan.  
Atma Singh Baxi.  
Krishnaswami Ayyar Subramania Ayyar.  
James John Dharmaraj.  
Panachayil Pinummootil Varkey George.  
Navanithakrishnan Money.  
Manohar Lal Gaiind.  
Nemam Eachambady Sarangapany.  
Hakim Nazir Hussain.  
Abdullah Khan Marwat.  
Phanindra Nath Banerjee.  
Mitranand Sharma.  
Shah Mohammad Quamrul Hoda.  
Indar Sen Jetley.  
Kallankandeth Narayan Kutti Menon.  
Krishanlal Atri.  
Samuel Victor Joseph.  
Homi Naoroji Dastur.  
Ponnambalam Pillai Kailasam.  
Pulikottill Ittoop Jacob.  
Karipaparambil Dominic Sebastian.  
Cheriyann Pallath Cheriyann.  
Mukund Balkrishna Kekre.  
Arathil Candeth Sreedharan Nambiar.  
Palathinkal Itthack George.  
Satyendra Nath Basu.  
Bhamidipati Joga Rao.  
Sailesh Chandra Ray.  
Sailendra Kumar Ghosh.  
Kalika Charan Dube.  
Rameshchandra Manjanath Nadkarni.  
Bhaskar Shantaram Wagley.  
Simili Ponnuswami Ramakrishnan.  
Kailash Narayan Mathur.  
Padmanabha Ananta Narayan.  
Budh Singh Sharma.  
Vasant Ramchandra Bagwe.  
Madhav Raghunath Thakar.  
Abdul Aziz.  
Jagannath Haribhai Patel.  
Shyam Bahadur Sinha.  
Stanislaus Mascarenhas.  
Debi Das Mitra.  
Partul Chand.  
Mohammad Saghir Yehya.  
Mohammad Said.

PROMOTIONS

*Colonel to be Major-General*

R. H. Candy, C.I.E. Dated 31st October, 1940.

*Captains to be Majors*

A. H. O'Malley. Dated 25th September, 1940.

M. Singh. Dated 15th November, 1940.

RETIREMENTS

Colonel D. F. G. Murphy, M.C., V.H.S. Dated 8th November, 1940.

Lieutenant-Colonel C. H. P. Allen. Dated 5th December, 1940.

The following retirements, with gratuity, is permitted:—

INDIAN LAND FORCES

(Short Service Commission)

Captain S. Sunkavally. Dated 2nd October, 1940.

Captain K. S. Aiyer. Dated 22nd October, 1940.

## Notes

### THE EMERGENCY CADRE OF THE INDIAN MEDICAL DEPARTMENT

WANTED medical licentiates or graduates for appointment as sub-assistant surgeons in the emergency cadre of the Indian Medical Department.

Rank—Jemadar.

Pay—Jemadars 75-5-145.

Pay—Subadars 160-5-175.

Allowances—Civil (Rs. 50/- p.m. to all), hair cutting, washing free.

Accommodation and rations—Free or compensation in lieu.

Travelling concessions—One and a half second class from ordinary place of residence to place of interview and back, with daily allowance for halt. Railway warrant on appointment.

Full particulars of terms and conditions and application forms obtainable from the undersigned.

P. S. MILLS,

MAJOR-GENERAL, I.M.S.,

Surgeon-General with the Govt. of Bengal.

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## Original Articles

### CLINICAL OBSERVATIONS ON LANDRY'S PARALYSIS

(BASED ON A STUDY OF 10 CASES)

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LANDRY, in 1859, described a disease characterized by an acute flaccid paralysis beginning in the lower limbs and rapidly spreading upwards to involve the trunk, upper limbs, neck, the bulbar and the respiratory centres. Since then, this syndrome of acute ascending paralysis has been observed by various workers in a number of diseases associated with gross pathological lesions of the nervous system, such as (a) an ascending form of acute anterior poliomyelitis, (b) acute ascending myelitis, (c) acute polyneuritis, specially of diphtheritic origin, (d) intrathecal hæmorrhage, (e) post-vaccinal and post-erythematous (smallpox and measles) encephalomyelitis, (f) rabies, and rarely (g) disseminated sclerosis (Brain, 1933). This syndrome has also occasionally occurred in the course of typhoid fever and antirabic inoculation. It is therefore desirable, in the interest of clarity, that the use of the term 'Landry's paralysis' should be confined to those cases of acute ascending paralysis where sensory and sphincteric disturbances are little or absent, muscular wasting is never marked, recovery is complete among the survivors and gross pathological changes in the nervous system are absent in the autopsy cases.

#### *Ætiology*

The ætiology of the disease is not definitely known. It is probably an acute form of polyneuritis of toxic or infective origin. The close resemblance of the disease to some cases of acute anterior poliomyelitis, post-vaccinal encephalomyelitis and rabies is strongly suggestive of an infection by a neurotropic virus. The infective agent has probably a selective affinity for the lower motor neurones, irrespective of the mode of entry, whether *via* the bloodstream or the axis cylinders of the olfactory nerves. The possibility of a bacterial infection is extremely doubtful, though Buzzard (1903) attributed some of his cases to a bacterial agent, a micrococcus.

#### *Pathology*

On a naked-eye examination the spinal cord and specially its grey matter show some hyperæmia with a few punctiform hæmorrhages.

Microscopical examination reveals vascular engorgement and varying grades of degenerative changes in the anterior horn cells and the cells of Clarke's column, such as chromatolysis and diffuse fatty changes. These changes are most marked in the lumbo-sacral enlargement which is the seat of the first paralysis. Perivascular infiltration, neuronophagia and neuroglial proliferation are absent. Slight fatty changes may be seen in the skeletal muscles. The cerebro-spinal fluid is clear and may show normal or increased pressure. The protein content is normal or slightly increased. The cell content is either normal or may show a slight lymphocytosis. In one of our cases the lymphocyte count was 20 per c.mm. Spontaneous coagulation of the fluid due to a high protein content has been reported by some observers. Enlargement of the liver, spleen and mesenteric lymph nodes is not infrequent.

#### *Clinical features*

*Incidence.*—Landry's paralysis is undoubtedly a rare disease. There were only seven cases in 49,284 admissions into the Medical College Hospital during the last 14 years, *viz*, 1926 to 1939. We came across three cases in the Howrah General Hospital during the last 5 years 1935 to 1939. According to Aring (1936) there were only seven cases in about 30,000 admissions into the Boston City Hospital from 1st September, 1933 to 1st August, 1934. The disease occurs usually between 16 and 54 years (Collier and Adie, 1929). In our series the age incidence was between 15 and 37 years. Males are more frequently affected than females. The ratio of males to females is 9 : 1 in our series.

*Mode of onset.*—The onset, though sometimes sudden, is usually gradual, ushered in by certain prodromal symptoms such as malaise, headache, insomnia, slight fever, anorexia, vomiting, diarrhœa, dull aching pains in the back and limbs and numbness of the extremities. In our series, the premonitory symptoms were as follows :—slight or moderate fever in six cases, vomiting and diarrhœa in one, pain and tingling sensation in the limbs in two and transient stiffness of the neck in one. It is interesting to note that in two cases premonitory symptoms were conspicuously absent.

*Psychical functions.*—Consciousness is retained throughout the illness. Intelligence, memory and judgment are unimpaired. Speech is usually normal.

*Cranial nerve functions.*—The cranial nerves are usually not involved except in severe cases. We have noted the infra-nuclear type of facial paralysis in three cases (unilateral in two, bilateral in one), dysphagia in four, hoarseness of voice in two, palatal paralysis in three, and diminished sensibility over the area of supply of the trigeminal nerve in one. Nystagmus indicating an involvement of the vestibular nerve or the cells of Clarke's column was

observed in one case. The occurrence of diplopia or ptosis has been reported in the literature, but we have not come across any such symptoms.

*Motor functions.*—Weakness first appears in the muscles of the lower limbs, one limb being affected a few hours earlier than the other. The proximal muscles are more affected than the distal, so that the movements of the fingers and toes may be present, though the limbs cannot be moved. In severe cases, the paralysis rapidly spreads upwards, in the course of a few hours to a few days, involving successively in the order of their innervation from the spinal cord, the muscles of the trunks, upper limbs, neck and those supplied by the bulbar nuclei. In some cases the muscular weakness may start in the face, neck or the upper limbs and then spread downwards to the trunk and the lower limbs. Such a descending type of Landry's paralysis was observed in two of our cases (*vide* cases 1 and 10). The paralysed muscles are flaccid and slightly tender on pressure. Wasting is usually absent but it may occur in a moderate degree, in cases where recovery is delayed beyond 2 or 3 weeks. It was present in two of our cases. Fibrillary tremors are absent. The electrical reactions are usually normal, but in cases associated with muscular wasting a partial reaction of degeneration may be present, as in two of our cases.

*Sensory functions.*—In most cases there is no objective loss of sensation. In three out of ten cases, a blunting of the sensibility to light touch and pin-prick over the distal parts of the limbs was present. In one of these three cases there was, in addition, a diminished sensibility of the conjunctivæ and corneæ with astereognosis and loss of sense of position in the fingers and toes.

*Reflexes.*—The superficial and deep reflexes are either absent or diminished in the affected area. The plantar reflex, if present, is flexor. In our series the deep reflexes (knee and ankle jerks) were absent in all, the superficial reflexes were absent in seven, sluggish in one and present in two. The functions of the sphincters are, as a rule, unimpaired though occasionally, as in two of our cases, retention of urine may occur in the early days but it clears up spontaneously in a few days. Some difficulty in emptying the rectum may also be present as in one of our cases.

*Trophic functions.*—Vasomotor changes or changes in the nutrition of the skin and nails are absent. Bed-sores are not known to occur.

*Constitutional symptoms.*—The constitutional symptoms are usually mild. The disease is, in most instances, afebrile except in the presence of bronchial or pulmonary complications. In six out of our ten cases the course was febrile.

*Blood picture.*—There is no distinctive blood picture of the disease. The average total

leucocyte count was 7,063 per c.mm., the maximum being 11,856 and the minimum 6,500.

*Course and prognosis.*—In unfavourable cases which constituted about 60 per cent of the total number in our series, the paralysis extended in the course of 6 to 13 days, either to the cervical region of the spinal cord, causing death by respiratory failure, or to the muscles of deglutition leading to death from aspiration broncho-pneumonia. Out of six deaths in our series, five were due to respiratory failure and one was due to bulbar paralysis. In two of the fatal cases respiratory failure was associated with diaphragmatic paralysis. In favourable cases, the paralysis ceases to spread and convalescence begins. The power of movement gradually returns, first in those muscles which were affected last. The distal muscles of the limb recover earlier than the proximal. A period varying from 3 to 6 months is often required for complete recovery. In two of our cases the recovery period was 2 and 4 months, respectively. In two other cases recovery was not complete even after 7 months and 2 years of convalescence. The occurrences of relapses and recurrences are unknown.

### Diagnosis

The diagnosis of a typical case of Landry's paralysis presents little or no difficulty. The onset of a rapidly spreading flaccid paralysis of the limbs and trunk, the absence of muscular wasting, sensory loss and sphincter disturbances and the occurrence of complete recovery if the patient survives are diagnostic features of the disease. Of course, in atypical cases the presence of slight sensory loss, muscular wasting with reaction of degeneration and sphincteric disturbances may throw doubt as to the real nature of the disease, but it must be remembered that these clinical features *per se* do not contra-indicate the diagnosis of Landry's paralysis. In such cases, however, before arriving at a diagnosis we have to differentiate it from (a) acute ascending type of poliomyelitis, (b) acute ascending myelitis and (c) intrathecal hæmorrhage.

From the acute ascending type of poliomyelitis, it is distinguished by (i) its rarity in childhood, (ii) wide-spread nature of the paralysis, and (iii) absence of high fever, signs of meningeal irritation, marked muscular wasting and reaction of degeneration. A high polymorphonuclear leucocytosis in the peripheral blood with a lymphocytosis in the cerebro-spinal fluid is strongly suggestive of poliomyelitis. The presence of a residual wasting on recovery excludes the diagnosis of Landry's paralysis.

From acute ascending myelitis it is easily differentiated by the absence of severe sensory loss below the level of the lesion, sphincteric disturbances, bed-sores, and Babinski's sign (unless the lumbo-sacral enlargement of the cord is affected or the transverse lesion is severe and complete). Moreover, in the former disease,

the motor paralysis, sensory loss and the sphincter paralysis occur simultaneously. Besides, acute myelitis is often of syphilitic origin and hence associated with a lymphocytosis of the cerebro-spinal fluid and a positive Wassermann reaction of the serum and cerebro-spinal fluid. Intrathecal hæmorrhage is distinguished from Landry's paralysis by the simultaneous appearance of motor paralysis, sensory loss and sphincter incontinence, and by the presence of hæmorrhagic cerebro-spinal fluid.

The distinction of Landry's paralysis from acute polyneuritis is artificial and of no practical value. Both the conditions have analogies on pathological and clinical grounds. Both are due to a toxic blood state and the toxic agent in both has a selective action on the lower neurones, both motor and sensory. In fact, in some instances of acute polyneuritis due to rabies, lead poisoning, diphtheria, and experimental curare poisoning, the selective action of the toxin is confined to the lower motor neurones only.

#### *Treatment*

In the absence of any specific remedy the treatment consists in (a) the maintenance of general body resistance by adequate nutrition and correction of associated anæmia, if there be any, (b) the elimination of the hypothetical toxins by diuretics, enemata, mild purgatives and daily drainage of cerebro-spinal fluid, (c) prevention of complications, and (d) relief of symptoms.

(a) Maintenance of the body resistance : For this purpose adequate nourishment is essential. The diet should be light and easily assimilable and yet should consist of the necessary quantities of proteins, fats, carbohydrates and vitamins, specially vitamin B<sub>1</sub>. If there is an associated anæmia, it must be treated with the appropriate drugs, *viz*, iron in large doses or liver-extract injections, according as it is hypochromic or hyperchromic.

(b) Elimination of toxins : Toxins are usually eliminated by the skin, kidneys and the bowels. Hence the administration of a diuretic and diaphoretic mixture and of mercurial purgatives is useful in ensuring elimination. Some of the toxin is circulating in the cerebro-spinal fluid and daily withdrawal of 15 to 20 c.cm. of cerebro-spinal fluid by a lumbar puncture will certainly reduce the toxic load and help the recovery of the nerve cells.

(c) Prevention of complications : The most serious complication that is to be guarded against is the paralysis of the respiratory and bulbar muscles. The patient should be propped up to help respiration and prevent hypostatic congestion. Hypodermic injections of strychnine sulphate in doses of grain 1/16, twice a day, to adults have been very helpful. Collier and Adie (1929) advocate injection of atropine to check the progress of the respiratory paralysis

and to prevent the accumulation of exudates in the bronchioles which may lead to collapse broncho-pneumonia. We have had beneficial results in some of our cases from the daily administration of vitamin B<sub>1</sub> (thiamine chloride), in the form of betaxin, in doses of 4,000 international units for 2 weeks. When respiratory paralysis supervenes artificial respiration should be continued with the aid of a Drinker's apparatus till the crisis is over. In cases of bulbar paralysis, there is great difficulty in feeding and maintaining nutrition. Besides, aspiration broncho-pneumonia is a common complication. In such cases feeding by the nasal or oesophageal tube should be resorted to. The mouth should be kept scrupulously clean by the use of antiseptic washes.

(d) Relief of symptoms : The symptoms such as pain, pyrexia and retention of urine are fortunately not persistent. Still the use of analgesics and antipyretics, such as aspirin and salicylates, is indicated in the presence of pain and pyrexia. If there is retention of urine the bladder should be catheterized every 8 hours under strict aseptic precautions.

#### *Case reports*

Case 1.—S., Muslim, male, aged 24 years, was admitted on 27th September, 1937, with the complaint of inability to move both the upper and lower limbs. This developed in the course of 3 days about 2 weeks before admission. The order of affection was right fingers, right forearm, right arm, left fingers, left forearm, left arm and then the legs. He had no premonitory symptoms, nor did any constitutional disturbance accompany the paralysis. Past history—kala-azar 14 years back. Family history—nothing contributory. Personal history—an employee in Bata Shoe Co., Ltd. He prepared rubber sheets for soles of shoes. Moderate smoker. No other addiction. None else in the workshop similarly affected. General examination—average build and nutrition. No anæmia, cyanosis, or jaundice. Temperature—98.4°F. Pulse/respiration—72/20. Nervous system—higher cerebral functions unimpaired; sleep—good; speech—normal. Cranial nerve functions—normal. Motor functions—loss of power in the muscles of both upper and lower limbs, more marked on the right side. Muscles—flabby, no wasting noticed on admission, but he developed some degree of wasting during the course of the illness. Fibrillary twitching absent. Sensory functions—unimpaired. Calf muscles slightly tender on pressure. Reflexes: abdominal reflex—sluggish; plantar reflex—flexor and sluggish; deep reflexes—absent; sphincters—normal. Trophic functions—normal. Alimentary system: spleen—just palpable; liver—not palpable. Respiratory system—no abnormality detected even though a careful watch was kept for any sign of involvement of the diaphragm and inter-costal muscles. Cardio-vascular and urinary systems showed no abnormality. Laboratory findings—Blood: hæmoglobin—80 per cent; leucocytes—9,900 per c.mm.; polymorphonuclears—56 per cent. Wassermann reaction—negative. Electrical reaction—partial reaction of degeneration in the affected muscles. Patient was discharged on 1st February, 1938. Cured without any residual paralysis.

Case 2.—P. K. M., developed Landry's paralysis in the course of an attack of epidemic dropsy. He was admitted on 25th July, 1938, with the following complaints:—(i) Swelling of the feet and legs with a red flush for 10 days, (ii) fever varying between 101°F. and 100°F. for the first 5 days, none for the last 4 days, (iii) inability to move the lower limbs for 3 days, (iv) difficulty in swallowing for 3 days,



(v) nasal intonation of voice for 2 days, (vi) palpitation for 10 days and (vii) hoarseness of voice for 5 days. Past history—nothing of importance. History of epidemic dropsy in the family. Personal history nothing contributory. General examination—patient toxic, no anaemia, cyanosis or jaundice. Temperature—100°F. Pulse/respiration—152/38. Nervous system—higher cerebral functions—normal; sleep—good; speech—normal. Cranial nerve functions—paresis of the soft palate and right side of the face; hoarseness of voice and dysphagia; no other abnormality. Motor functions—paralysis of the muscles of the lower limbs and paresis of the muscles of the upper limbs. Sensory functions unimpaired. Both superficial and deep reflexes absent. Sphincters normal. Trophic changes absent. Skull and vertebral column normal. Respiratory system—air entry into lungs moderate. Alimentary system—tongue thickly coated and dry; liver enlarged two fingers and tender; spleen—not palpable. Cardio-vascular system—heart sounds weak and rapid. Urinary system—nothing abnormal. Laboratory findings—Blood: haemoglobin—70 per cent; leucocytes—7,126 per c.mm.; polymorphonuclears—80 per cent. Sedimentation rate 37.5 mm. per hour. Patient succumbed on 28th July, 1938, on the 12th day of the illness, from paralysis of the diaphragm.

Case 3.—A. B. D., Hindu, male, aged 37 years, was admitted on 26th July, 1938, with the following complaints:—(i) Pain in the legs, (ii) inability to move the lower limbs and (iii) fever. He had at first pain in the medial aspect of the thighs but this extended down to the legs later on. Fever developed 2 days later and paralysis of the lower limbs 3 days later. Past, family and personal history—nothing of importance. General examination—build and nutrition—poor; anaemia present; no jaundice or cyanosis. Temperature—100°F. Pulse/respiration—118/26. Nervous system—higher cerebral functions unimpaired; sleep—good; speech—normal. Cranial nerve functions normal. Motor functions—paralysis of the muscles of the lower limbs. Paresis of the muscles of the upper limbs. Sensory functions normal. Some wasting of the paralysed muscles present. Fibrillary twitchings—absent. Reflexes—superficial reflexes absent; knee and ankle jerks absent; biceps, triceps and supinator jerks normal. Sphincters—control of the vesical sphincter was lost but is now normal; defaecation normal. Trophic functions normal. Skull and vertebral column normal. The respiratory, alimentary and circulatory systems showed no abnormality. Laboratory findings—Blood: haemoglobin—65 per cent; leucocytes—9,672 per c.mm.; polymorphonuclears—79 per cent. Urine—*B. coli* on culture. No abnormality detected in the stool. Patient was discharged on 3rd September, 1938, in a much improved condition.

Case 4.—L. P., Chinese, male, aged 25 years, was admitted with the following complaints:—(i) weakness of both upper and lower limbs, (ii) fever, (iii) difficulty in breathing, and (iv) difficulty in swallowing solid food. He developed the above complaints in the course of 10 days in the following order: fever, weakness of the lower limbs and weakness of the upper limbs. Past, family and personal history—nothing contributory. General examination—build and nutrition moderate. Cyanosis present; no jaundice or anaemia. Nervous system—higher cerebral functions unimpaired; speech normal; sleep good. Cranial nerve functions—difficulty in swallowing solid food; no other abnormality. Motor functions—loss of power in the muscles of both upper and lower limbs; slight wasting; fibrillary twitchings absent. Sensory functions unimpaired, only tender calf muscles during the early stage. Deep reflexes absent. Trophic functions unimpaired. Skull and vertebral column normal. Respiratory system—sucking in of the epigastrium during inspiration (paralysis of diaphragm); rate 30 per minute. Cardio-vascular and alimentary systems—nothing abnormal. Laboratory findings—Blood: leucocytes 6,500 per c.mm., polymorphonuclears 69 per cent; Wassermann reaction negative. Urine and stool—nothing abnormal. Patient died of respiratory failure on the 13th day of the illness.

Case 5.—N. K. B., Hindu, male, aged 20 years, was admitted with the following complaints:—(i) paresis of the upper and lower limbs for 5 days, weakness first developed in the lower limbs, (ii) intermittent fever, (iii) nasal intonation of voice for 5 days and (iv) difficulty in swallowing liquids. Past and family history—nothing contributory. General examination—build and nutrition average. Cyanosis present. Temperature—100°F. Pulse/respiration—104/36. Nervous system—higher cerebral functions normal; sleep normal; speech normal. Cranial nerve functions—nasal voice (paralysis of the soft palate); difficulty in swallowing liquids; no other abnormality. Motor functions—paresis of the muscles of the upper limbs; complete paralysis of the muscles of the lower limbs; no wasting. Fibrillary twitchings absent. Sensory function unimpaired. Reflexes—both superficial and deep reflexes absent. Sphincters normal. Trophic changes—nil. Skull and vertebral column—normal. Respiratory system—sucking in of the epigastrium during inspiration (paralysis of diaphragm). Alimentary and cardio-vascular systems—nothing abnormal. Died of respiratory failure on the 8th day of the disease.

Case 6.—S. B., male, aged 30 years, admitted on 31st December, 1937, with all the signs and symptoms similar to those of N. K. B. (case 5) except that there was no paralysis of the diaphragm. The bulbar involvement was more marked. Patient died on 1st January, 1938, on the 6th day of his illness, 24 hours after admission.

Case 7.—K. S., Buddhist, aged 25 years, was admitted on 4th April, 1939, with the following complaints:—(i) fever—5 days, (ii) severe pain in left lower limb—3 days; the pain spread to the right lower limb the next day, (iii) loss of power of the left lower limb—3 days, (iv) loss of power of the right lower limb—2 days and (v) retention of urine—24 hours. The patient took some purgative 4 days back as a result of which he had six loose stools and two vomits and then he developed the above complaints. General examination—patient exhausted; build and nutrition—moderate. Nervous system—higher cerebral functions normal. Cranial nerve functions—nystagmus present; no other abnormality. Motor functions—paralysis of both lower limbs; no wasting. Fibrillary twitchings absent. Neck slightly rigid. Sensory functions—unimpaired. Reflexes—superficial: abdominal present; plantar—no response. Knee and ankle jerks absent; biceps and triceps jerks sluggish. Sphincters—retention of urine, no evacuation of the bowels; patient had to be catheterized and given enemata. Trophic changes—nil. Skull and vertebral column normal. Respiratory, alimentary, urinary and cardio-vascular systems revealed nothing abnormal. Laboratory findings—Blood: haemoglobin 70 per cent; leucocytes 11,856 per c.mm.; polymorphonuclears—74 per cent. Urine and stool—nothing abnormal. Blood urea—50 mg. per cent. Wassermann reaction—negative. Electrical reaction—reaction of degeneration in the muscles of both lower limbs. Patient was discharged on 21st May in a much improved condition; sphincters became normal; power in the lower limbs was gradually returning and the patient could move his right great toe.

Case 8.—Mrs. R., Anglo-Indian, female, aged 37 years, was admitted on 2nd June, 1935, with the following complaints:—(i) pain and tingling sensation all over the body, (ii) pricking sensation in the hands and feet and (iii) inability to walk or stand. General examination—build and nutrition moderate. Jaundice, anaemia and cyanosis—nil. Temperature—98.4°F. Pulse/respiration—84/24. Nervous system—higher cerebral functions unimpaired; sleep normal; speech normal. Cranial nerve functions—diminished conjunctival and corneal sensibility on both sides. Paralysis of the facial nerve on both sides (infra-nuclear type). Loss of pharyngeal and palatal reflexes. Hoarseness of voice. Motor functions—complete paralysis of the muscles of the lower limbs; paresis of the muscles of the upper limbs; muscles flaccid; no wasting; co-ordination lost (as shown by the finger-nose test). Sensory functions—loss of sensation to light touch in both legs up to the middle of the thighs; hyperaesthesia of the soles of the feet; joint sense in the fingers and



toes lost; astereognosis present. Reflexes—superficial: no response; knee and ankle jerks absent; biceps, triceps and supinator jerks sluggish. Sphincters—normal. Trophic changes—*nil*. Skull and vertebral column—normal. Respiratory, alimentary, cardiovascular and urinary systems—nothing abnormal. Laboratory finding—Wassermann reaction moderately positive. Patient was discharged on 27th May, 1935, almost completely cured but for a slight facial weakness of the right side.

Case 9.—B. L., Hindu, male, aged 37 years, was admitted on 8th November, 1938, with the complaint of loss of power of both lower and upper limbs for 8 days. General examination—build and nutrition moderate. Anæmia and jaundice—*nil*. Temperature 98°F., pulse 80, and respiration 20 per minute. Nervous system—higher cerebral functions unimpaired; sleep normal; speech normal; cranial nerve functions—unimpaired. Motor functions—paralysis of the muscles of the lower limbs; paresis of the muscles of the upper limbs. Sensory functions—slight blunting of sensation over the lower limbs. Reflexes—absent. Sphincters normal. Trophic changes—absent. Skull and vertebral column normal. Respiratory system—patient was reported to have respiratory difficulty before death. Alimentary system—spleen slightly enlarged. Cardio-vascular and urinary systems—nothing abnormal. Laboratory findings—Blood: leucocytes 11,820 per c.mm.; polymorphonuclears 68 per cent; a few M. T. rings and crescents found. Wassermann reaction of serum doubtful. Cerebro-spinal fluid was clear, 20 cells per c.mm. (majority lymphocytes); Wassermann reaction strongly positive. Patient died of respiratory failure 3 days after admission on the 11th day of the disease.

Case 10.—M. M., Hindu male, aged 35 years, was admitted on 12th January, 1939, with the complaints of tingling and weakness in the upper and lower limbs. The weakness and tingling were first noticed in the upper limbs 8 days ago. General examination—build and nutrition moderate; jaundice and anæmia present; no cyanosis. Pulse/respiration 108/24. Nervous system—higher cerebral functions normal; sleep normal; speech normal. Cranial nerve functions—paresis of the right side of the face; no other abnormality. Motor functions—muscles of the upper and lower limbs parietic; no wasting; fibrillary twitching absent. Sensory functions—impairment of sensation to light touch over the distal parts of the upper and lower limbs. Reflexes—both superficial and deep reflexes absent; sphincters normal. Trophic changes—*nil*. Skull and vertebral column normal. Respiratory system—scattered râles in both lungs. Alimentary system—liver and spleen just palpable. Cardio-vascular system—nothing abnormal. Urinary system—nothing abnormal. Laboratory findings—Blood: hæmoglobin 60 per cent; leucocytes 6,500 per c.mm.; polymorphonuclears 60 per cent; Wassermann reaction negative. Patient developed paralysis of the diaphragm 4 days after admission and died on the 13th day of the illness.

### Comments

A typical case of Landry's paralysis is characterized by (1) ascending flaccid paralysis unassociated with any wasting of muscles, (2) loss of tendon reflexes, (3) absence of sensory loss and sphincter disturbances and (4) absence of reaction of degeneration. A study of our cases however reveals that seven of them (cases 1, 3, 4, 7, 8, 9 and 10) presented one or more atypical features; thus case 1 showed wasting of the affected muscles with partial reaction of degeneration; case 3 showed some wasting of the paralysed muscles, as well as retention of urine though lasting for the first 3 days. Case 4 also showed some wasting of the affected muscles. In case 7 there was retention of urine and faeces for a few days. Moreover, a reaction

of degeneration was present in the muscles of lower limbs. In cases 8, 9 and 10 there was blunting of sensation to cotton-wool and pin-prick over the lower limbs. In case 8, there were in addition some loss of sensibility over the cornea and conjunctiva, astereognosis and loss of sense of position of the fingers and toes.

Further analysis reveals that there was some residual paralysis in one of the lower limbs in cases 7 and 3 even after 7 months and 2 years of convalescence respectively. The presence of a positive Wassermann reaction of the serum in case 8 and of a positive Wassermann reaction of the cerebro-spinal fluid in case 9 was a mere coincidence. A much more interesting finding is the presence of a few malignant tertiary rings and crescents in case 9. It may be argued that in this case Landry's syndrome was caused by a malignant tertiary infection and its concomitant embolic lesions of the spinal cord. But such a hypothesis was untenable because the patient was afebrile, quite conscious and his blood examination revealed both rings and crescents indicative of an old infection.

### Summary

- (1) An attempt has been made to define Landry's paralysis.
- (2) Its ætiology and pathology have been briefly discussed.
- (3) The clinical picture of the condition has been described in detail on the basis of an analytical study of ten cases.
- (4) The prognosis and differential diagnosis have been dealt with.
- (5) Ten case notes have been appended.
- (6) The atypical features of Landry's paralysis have also been commented upon.

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## TREATMENT OF TUBERCULOSIS VERRUCOSA CUTIS BY LOCAL APPLICATION OF CREOSOTE AND SALICYLIC ACID

By D. PANJA, M.B. (Cal.)

(From the Medical Mycology Enquiry, under the Indian Research Fund Association, School of Tropical Medicine, Calcutta)

THE treatment of lupus vulgaris by the application of caustics has been a common method for many years. Among caustics two of the most popular are creosote and salicylic acid, either separately or in combination. Beatty (1928) treated 4 per cent of his cases of lupus vulgaris by pyrogallol ointment, acid nitrate of mercury, alkaline phenol and salicylic acid-creosote plaster. According to him the salicylic acid and creosote plaster acted well in some cases, but was slow. He, however, did not describe the variety of lupus vulgaris that responds best to this plaster.

During the last few years we have tried various caustics in treating different kinds of lupus vulgaris and we find that creosote and salicylic acid in paste form seems to give fairly good results in selected cases of lupus verrucosa. Lupus verrucosa, or tuberculosis verrucosa cutis, is characterized mainly by warty vegetations on an inflammatory base, affecting chiefly the extremities, the dorsum of the fingers and toes, the buttocks, and the thick skin of the palms and soles. The vegetations are more prominent in thick than in thin skins. It differs histo-pathologically from lupus vulgaris by the marked hyperkeratosis of the stratum corneum and predominant acanthosis of the prickle-cell layer, the tubercle with giant cells of the Langerhans' type being the same in both diseases (figure 1).

Creosote and salicylic acid paste does not give uniformly good result in all cases of tuberculosis verrucosa cutis; it varies in different stages of the disease as well as in different parts of the body. We are now able to classify the types of disease according to their response to the paste treatment.

Type 1.—Lesions on the thick skin of the palms and soles with well-marked vegetations (figure 7).

Type 2.—Lesions on the dorsum of fingers, toes and feet with hard heaped-up vegetations (figure 11).

Type 3.—Lesions on the other parts of the body, especially the extremities where the vegetations are not so hard and prominent (figure 9).

The cases belonging to type 1 gave the best response to the paste treatment; type 2 cases gave a less favourable result in big patches but were good in small isolated patches; while the third type of case did not improve much, as it was not possible for us to use the paste in its original form on the soft skin owing to the intense burning pain it caused.

### *The preparation of the paste and its method of application*

The paste consists of three parts of creosote and two parts of salicylic acid which are mixed on a tile by means of a spatula.

The healthy skin round the lesion is first coated with vaseline for protection. A layer of the paste about a quarter of an inch thick is then applied on the lesion and kept exposed for 5 to 10 minutes, so that the creosote may soak into the vegetations and not spread on the surrounding skin, as it will do if bandaged at once. After this period the lesion with the paste is covered by a piece of oil-paper with cotton-wool on the top of it and tightly bandaged. The tight bandaging is very important as it forces the paste into close contact with the lesion. The dressing is kept for 48 to 72 hours. When it is removed, it is found that the entire group of warty vegetation has become brittle



Fig. 1.—A photomicrograph of the section made from the biopsy material of one of our cases. This shows hyperkeratosis and marked acanthosis of the prickle-cell layer. At the base of the hypertrophied epidermis the changes are more prominent in the corium where there is cellular infiltration of the granulomatous type with the formation of tubercles containing giant cells of various sizes.

and can be removed easily with a pair of dissecting forceps, and a red clean ulcer is left. The ulcer heals up rapidly with a dressing of borovaseline only and without secondary complication except scarring. In lesions on the fingers and toes where the bone is close to the skin, healing takes a long time and a bad scar is left behind. In some cases, a second or even a third application is necessary.

### *Modification of the above method of treatment*

In the third type of case, where the original paste of creosote and salicylic acid was not

suitable for local application owing to the intense burning pain and troublesome ulceration it caused, a modified paste diluted with glycerine was used according to the following formula :—

Creosote	..	.. 2 parts.
Acid salicylic	..	.. 2 "
Glycerine	..	.. 4 "

The cases respond to this modified treatment if it is continued for a long time. In a few cases of lupus vulgaris this therapy was tried but to no effect; on the contrary most of the patients did not come back probably because of the intense pain.

In addition to the usual treatment with the paste, the general health of the patient should be improved by tonics.

A few cases exemplifying the paste treatment are given :—

*Case 1.*—A Hindu male, aged 27 years, cultivator by occupation, developed the lesion two years ago as a tiny nodule which gradually extended to the present size (figure 2).

There was a mild and slightly painful warty excrescence with a few small depressed scars due to healing of small abscesses, a characteristic feature of the lupus verrucosa. The creosote and salicylic acid paste was applied and it was removed after 72 hours, when the entire vegetations with a little healthy surrounding skin came off leaving a red raw ulcer (figure 3). This ulcer healed up within a fortnight with a dressing of borovaseline only (figure 4).

*Case 2.*—A Moham-medan male, aged 31 years, working as a mill-hand in a jute mill, developed the disease three years ago; the lesion covered the middle third of the sole of the left foot. The creosote and salicylic acid paste was applied and the slough formed thereby was removed after 48 hours when a clean ulcer was formed (figure 5). This ulcer rapidly healed with a simple borovaseline dressing; but a portion of the tuberculous lesion still remained unaffected (figure 6). Here a second application of the paste was necessary.

*Case 3.*—A Hindu male, aged 24 years, working in the railway as a fitter, had been suffering from the disease for the last ten years. At the present stage, it is extensive with heaped-up warty excrescences covering more than one-third of the sole of the left foot (figure 7). A thick layer of the creosote and salicylic acid paste was applied and though the patient felt more pain than that of the previous patients the result was very encouraging. The entire warty vegetations were removed still leaving some tuberculous material at the margin (figure 8). In this case a second and a third application of the paste was necessary.



Fig. 2.

Fig. 3.

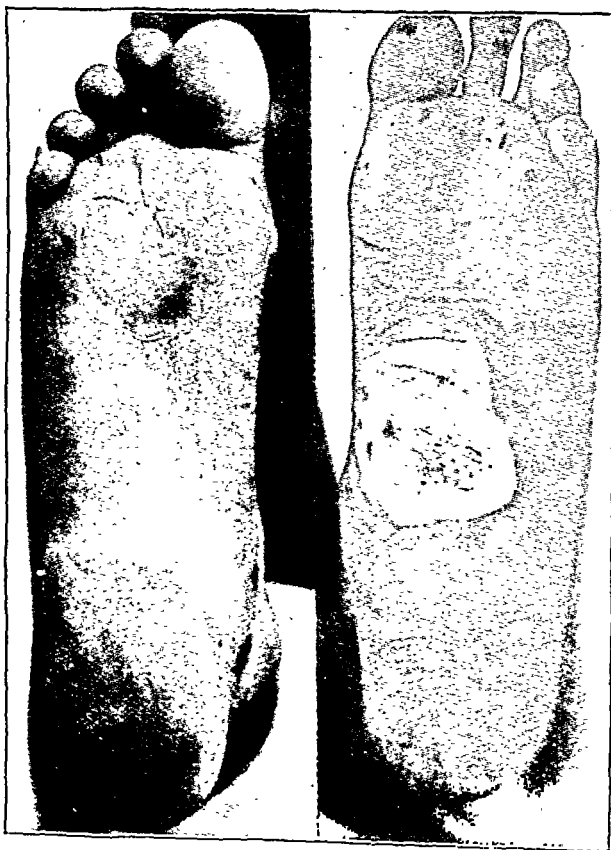


Fig. 4.

Fig. 5.



Fig. 6.

*Case 4.*—A Hindu boy, aged 12 years, had the disease on the dorsum of the right foot for more than one year. There were soft warty excrescences about the size of a rupee (figure 9). The paste was applied and the redundant warty growth came off within 48 hours



Fig. 7.

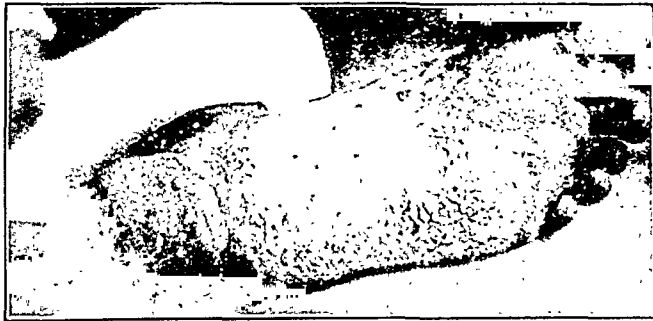


Fig. 8.

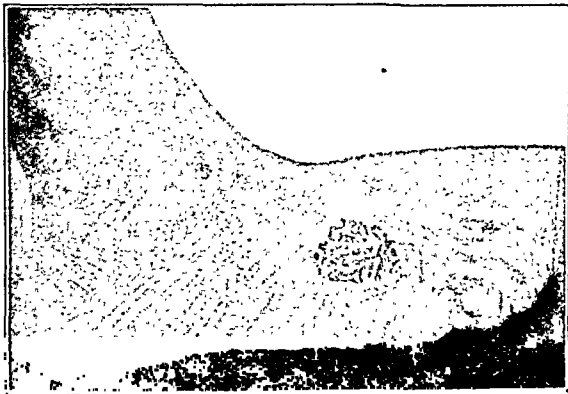


Fig. 9.

leaving a small diseased area (figure 10), which did not respond to the second application and the patient refused a third application owing to the pain he experienced on the second occasion.

Figure 11 shows how the dorsum of finger is affected with the disease, showing typical warty excrescences.

#### Discussion

These two chemicals, salicylic acid and creosote, possibly exert a selective action on the disease which may be explained as follows :—

The former softens the hard and thickened vegetations of the stratum corneum, thereby allowing the creosote to penetrate into the

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#### PRE-AURICULAR FISTULÆ

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This subject was brought to the notice of the medical profession in Britain first by Sir James Paget in the year 1878. Then, Sir Arthur Keith demonstrated some specimens in the museum of the Royal College of Surgeons, and published papers in 1909. Later, papers were published by Evans (1910), Fournier (1919), Paget and Rugani, Pritchard, and lastly by Stammers in 1926. The last author has brought the subject up to date, and has been freely quoted.

This condition, which is a congenital anomaly, may manifest itself as a dimple, sinus, fistula, abscess, chronic ulcer, dermoid, auricular appendage, or an ugly scar situated in front of the ear. Usually, they are unilateral, but

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tubercle where it destroys the bacilli. So this remedy has two advantages, one is the mechanical removal of the pathological tissues by the salicylic acid and the other is the destruction of

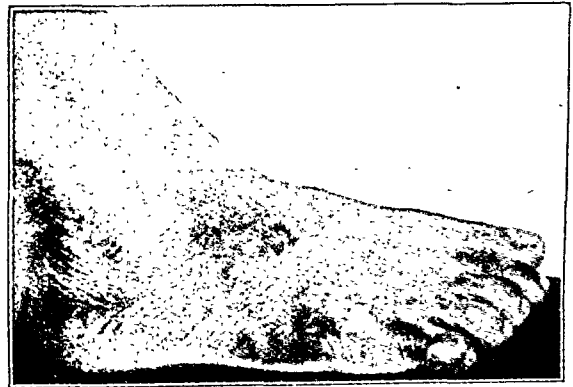


Fig. 10.



Fig. 11.

bacilli by the creosote. The disadvantages of pain and discomfort for 48 to 72 hours during which the paste is on can usually be tolerated by intelligent patients who are anxious to be free from a chronic troublesome disease.

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occasionally may be bilateral (as in one of my cases). Stammers has laid great stress on the condition being familial and hereditary, but that claim could not be substantiated in my cases. The condition is not very common, but at the same time is not very rare. I have come across seven cases during the past sixteen months; of these one had three sinuses and a big scar; two had one sinus and an ulcer each; and four had one sinus each without any complications.

*Situation.*—The opening of the sinus may be present at the junction of any two of the six tubercles which go to form the pinna, but it has been seen that the most common sites are the crus helix and the tragus.

*History.*—The usual history of the case is very typical and characteristic. The child is born with a dimple in one of the sites mentioned above. Unfortunately, in our country, some people attach a religious significance to such congenital defects. The parents consider it a good omen, because such a baby is believed to be a born 'Yogi' (the well-known Kanphata-Yogi, that is, a Yogi with torn ears)—the more so if the condition is bilateral. This dimple is the external orifice of the track which is superficial in character, lined with the skin epithelium, is directed downwards and forwards, but does not involve the bone. For a few years the track remains clean, but later on some thick greyish-white foul-smelling discharge can be pressed out. This is only the secretion of the epithelium lining the track, which sometimes becomes inspissated. The mouth of the track may become

blocked by the secretions drying up, causing discomfort and swelling of the part behind. The plug may dislodge itself or may be removed by thoroughly washing the part with soap and water giving relief to the patient. But sometimes, through want of proper cleanliness, or accidentally, infection supervenes and an abscess is formed. This is treated on general lines. Either it opens by itself or is opened by the knife. The fistula forms and later may temporarily close, but



Fig. 1.—Showing the right side of the face of case 1.  
1. Scar in front of the ear.  
2. Opening of the sinus at the crus helix.  
3. Opening of the sinus in front of the tragus.

re-opens after a few days. This state of affairs goes on for a long time, and to the great astonishment and disgust of the medical attendant the fistula refuses to heal. The constant irritation by the secretion leads to ulceration, which goes on spreading and causing great

discomfort and disfigurement of the patient's face. These patients usually wander from place to place and try to obtain relief through any system of medicine; the unqualified, the untrained, and the quacks being consulted most, because they claim to produce miracles. Thus, the treatment is carried out empirically and symptomatically without removing the root cause of the trouble. When, however, the correct diagnosis is made the treatment becomes simple, sure, and rapid.

*Diagnosis.*—Knowledge of the development and the anatomy of the part should guide one to the correct diagnosis. The condition is so obvious that it should never be missed if one knows what to look for. A lump or a chronic ulcer in front of the ear should always remind one of the presence of the pre-auricular sinus underlying the condition. One should always look for the tiny opening in one of the sites described above. It is only

when careful examination fails to reveal the presence of any congenital defect that one should proceed to look for some of the other causes of the condition, such as sebaceous cyst, dermoid, lipoma, osteomyelitis of the zygoma, tubercle, syphilis, etc., etc.

*Treatment.*—This consists in thoroughly excising the whole track in one mass, and endeavour should be made to include the ulcer base also. Cauterization of the track has been tried, but the results have not been very encouraging, as there is always a chance of leaving behind small bits of the epithelium, which may be responsible for keeping up the condition. Cold steel knife is decidedly better than the cautery.

*Incidence.*—Of all the cases coming up for examination Eyle found the condition present in 0.26 per cent, Bezold and Urbantschitsch in 0.19 per cent, while Rugani got much higher figures. I have seen seven cases out of about 6,800, in



Fig. 2.—Showing the left side of the face of case 1. Opening of the sinus at the crus helix.

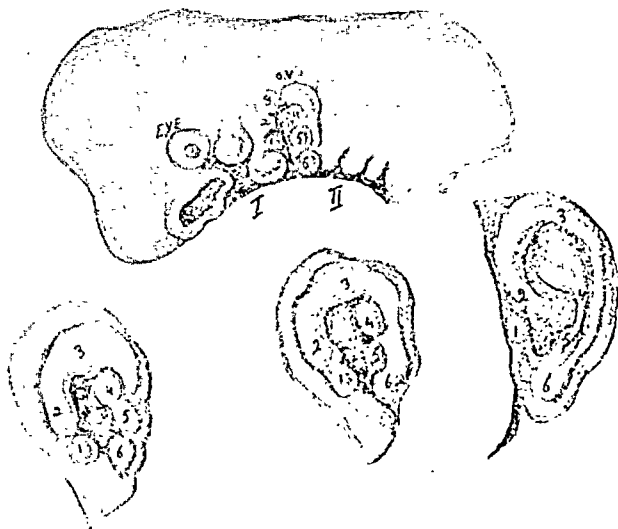


Fig. 3.—Showing the right side of the face of case 2.  
1. Opening of the sinus at the crus helix.  
2. Ulcer in front of the ear.

the past sixteen months. Of these 7 cases, the following three are described in detail, because they had some complications:—

**Case 1.**—A boy, 5 years old, poorly developed. At the age of 2 years, he developed an abscess in front of the right ear, which was opened. The sinus persisted for about 3 years, and a big ulcer was formed; it was treated at various places by ointments, lotions, etc., but the relief was always temporary.

Fig. 4.



Figures modified from His, illustrating the formation of the pinna. (Prentiss Ary—*Textbook of Embryology*.)

- I. Mandibular arch, with elevations on it.
- II. Hyoid arch, with elevations on it.
- O.V. Otic vesicle.
- 1. Tragus.
- 2. Crus helix.
- 3. Helix.
- 4. Antihelix.
- 5. Antitragus.
- 6. Lobule.

**Examination.**—A small pin-point opening at the root of the helix on both sides. A lachrymal probe could be passed in it for 2.5 cm. downwards and forwards. There was no pain, tenderness or any discharge, not even on pressure. Owing to the bilateral nature of the lesion, the child was considered a Yogi.

A small pin-point opening 0.75 cm. in front of the tragus of the right ear. A lachrymal probe could be passed in it for 3 cm. There was no pain, tenderness, or discharge, not even on pressure, but the father of the child said that at times thick, greyish-white discharge could be pressed out.

A large circular scar in front of the right ear, 4.5 cm. in diameter. In this scar, the second (*v.s.*) opening was situated.

X-ray examination of the part did not reveal any evidence of bony lesion.

**Case 2.**—A girl, 3½ years old, in fairly good health. At the age of 2½ years, a lump appeared in front of the right ear, was treated by various remedies, ointments, lotions, fomentations, etc., but the condition did not respond to treatment. Eight months later, she was operated on, even that did not give any relief.

**Examination.**—A pin-point opening at the root of helix of the right ear. A lachrymal probe could be passed in it for 2½ cm., downwards and forwards. It emerged out at the base of the ulcer (*v.i.*) through a small opening. Saline injected through the opening by means of a hypodermic needle and syringe came out through the ulcer base.

A chronic ulcer in front of the right ear, 4 × 3½ cm., irregular in outline; base hard and fixed to the underlying tissues; surface covered with unhealthy

granulations—pale, anæmic, and bleeding readily on touching; edges very irregular, pale, and in some places undermined, and there was a profuse foul discharge from it.

**Case 3.**—A girl, 6 years old, poorly nourished. At the age of 2½ years she developed an abscess in front of the left ear, which burst under treatment; later, an ulcer was formed which has not responded to any treatment; she has been operated on four times at different places. Now she suffers considerably from the pain and foul smell.

**Examination.**—A pin-point opening at the root of the helix of the left ear. A lachrymal probe could be passed in it for 4 cm. downwards and forwards. It emerges at the base of the ulcer (*v.i.*) through a small opening.

A chronic large ulcer in front of the left ear 5 × 4 cm., irregular in outline, base hard and fixed, surface trabeculated and pale unhealthy granulations in between which readily bleed, edges irregular, and there is profuse discharge from it.

**Treatment.**—Treatment in all cases was the same. Hypertonic (10 per cent) saline compresses 4 hourly were applied for 3 to 7 days until the surface became clean. Then the track was excised in one mass including the ulcer with it. Under the base of the ulcer, thick hard fibro-cartilaginous tissue was found, which was removed. Silkworm-gut stitches were applied, and it was found that everything healed by first intention, except a small part of the ulcer in case 3, which took 5 days more to heal. So the results in all my cases have been very encouraging.

**Discussion.**—In order to understand fully the nature and the origin of these sinuses, fistulæ, and ulcers, one must go into the development of the parts, and the various theories which go to explain their origin.

**Development.**—The external auditory meatus and the concha are developed from the first branchial cleft, and the pinna from the six tubercles situated around the posterior end of this cleft, two being in the first arch, three in the second, and the remaining one at the junction of the two. These six tubercles are destined to form the tragus, crus helix, helix, antihelix, antitragus, and the lobule, respectively. The part that forms the external auditory meatus lies between the tubercles nos. 1 and 2, in front, and the tubercles nos. 4, 5 and 6 behind, and any defect or deformity resulting from the remains of the first cleft will lie between the tragus in front and the lobule behind, and will, moreover, communicate with the concha and the external auditory meatus.

During coalescence of the six tubercles, tiny subcutaneous tracks may be left over. The fistulæ of this series of cases are developed mostly in the area of coalescence of tubercles nos. 1 and 2; and most of the sinuses occur in the region of the crus helix and the tragus. The downward and forward direction of the fistulæ can be explained by the downward and forward development of the mandibular arch with its maxillary process.

The auricular appendage, which is not infrequently noticed, is a process most commonly derived from a subdivision of the tragus. There



is evidently a relationship between the auricular appendages and the fistulæ, for it was noted by Sir Arthur Keith that one of the commonest sites for their occurrence is in front of the ascending root of the helix, the point at which a depression or fistula would be formed if a pre-helical appendage becomes submerged during development. The fistula which is found on the ascending helix occurs at the point where the two tubercles fuse together to form the anterior or the mandibular part of the helix. When one remembers that the external ear is formed out of six tubercles which fuse together across the first cleft, one wonders why gaps and fistulæ are not of more common occurrence.

*Theories of origin.*—1. Fistula is the remains of the first branchial cleft.

The formation of the sinus must be between the tragus in front and the lobule behind, and it must extend into the external auditory meatus and the concha. The majority of the old textbooks and some authorities, such as Virchow, Schwartz, and Urbantschitsch, favoured this view; but others, for example, His, Gradenigo, Rugani, and Brash, are of the opinion that there is no connection between the fistulæ and the first branchial cleft.

2. Failure of union of the soft parts corresponding to, and overlying the posterior ends of, the mandibular and maxillary processes of the first branchial arch.

According to this, such fistulæ are the posterior end of a macrostoma, though the anterior end is normal, so that no actual macrostoma is present, the soft parts overlying the posterior end of the mandibular bar and its maxillary process have just failed to unite. This theory explains the direction of the fistulæ. But even in its severest form a macrostoma never extends quite so far back as the ear. The bony parts unite all through, but the soft parts may fail to unite in the posterior part, forming a small sinus.

3. Failure of union between some two of the six tubercles, which appear around the posterior end of the first branchial cleft, and which go to form the pinna, or some anomalous process occurring in connection with these tubercles.

This is the most favoured theory. Most of the fistulæ are situated at the root of the helix or in front of the tragus; the sinus is superficial, lined with skin epithelium, and the bone is not involved.

From the above it would appear that theory no. 1 does not help us at all to explain the formation of these fistulæ. Theories nos. 2 and 3 seem to have a great deal of truth in them, though each one alone cannot explain all the factors. A combination of both would be a more plausible explanation. The direction of the sinuses is best explained by theory no. 2, whereas the site is more in favour of the theory no. 3.

*Summary.*—1. Pre-auricular sinuses and fistulæ are not infrequent. Seven cases are  
(Continued at foot of next column)

## KAPOSI'S DISEASE

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THREE cases of this extraordinary condition recently came under observation. The affection was first described by Moriz Kaposi and given the name of xeroderma pigmentosum\*. A large number of other names have been given, examples of which are atrophoderma pigmentosum (Crocker), melanosis lenticularis progressiva (Pick), and lioderma cum melanosi et telangiectasia (Neisser). Since these names are somewhat cumbersome and are not quite accurate from a descriptive standpoint, the association of Kaposi's name might well be retained, and, though the clinical features of the cases observed in patients living under tropical conditions appear to differ in important respects from those seen in Europe, Kaposi's (1895) description may with advantage be quoted :

'The face, ears, neck, shoulders, the chest to the level of the third rib, the arms and backs of the hands, sometimes the dorsal surfaces of the feet, are dotted with larger and smaller yellowish brown patches like freckles. Between these are found pock-like, whitish, glistening, shallow depressions, or the integument has a normal colour. The variegated appearance of

\*The etymologically-more-correct name 'xeroderma pigmentosa' is used in the *British Encyclopædia of Medical Practice*. The disease is not very rare in Calcutta: a dozen cases or so have been treated at the skin clinic of the Calcutta School of Tropical Medicine during as many years; they usually turn up in batches, two or three members of the same family.—EDITOR, *J. M. G.*

(Continued from previous column)

reported, of which three were complicated, and have been described in detail.

2. History of the cases do not show any familial or hereditary tendency.

3. Prognosis is very good under proper treatment.

4. Treatment consists of complete excision of the track.

5. The exact mode of formation is uncertain, no single theory being enough to explain all the factors.

In conclusion, my thanks are due to the medical superintendents of Sir Gangaram hospital and Ishardas Kapur hospital, for kindly allowing me to publish these notes.

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the skin is intensified by numerous punctate or linear telangiectases. The epidermis is thin, in places smooth, and in other places it is detached in thin lamellæ, or finely furrowed, fissured, wrinkled, dry like parchment. The cutis itself feels thin, but often, when the disease has lasted for some time, it is with difficulty raised into folds; it is more firmly adherent to the underlying tissues and is poor in fat. The general integument of the rest of the body is normal in every respect. So far as we can learn the disease always begins in earliest childhood and progresses steadily. Small telangiectases and pigment patches first develop; then the vessels are almost entirely obliterated and corresponding achromatic whitish glistening atrophic depressions are left over. Later, there is diffuse shrinking of the skin, above which the epidermis becomes wrinkled and is detached in lamellæ. The increasing shrinking of the skin is followed by eczema, shallow rhagades and ulcers, narrowing of the mouth and nares, and ectropion of the lower lids (this gives rise occasionally to xerosis of the cornea). In the majority of cases (five times among my ten cases) carcinoma, sarcoma, or angioma has developed in a few months upon scattered parts of the face, lips, nose, lids, cheeks and concha of the ear. In two cases internal metastases developed with fatal termination.

*The disease in India.*—The cases observed were amongst the indigenous population who normally possess a greater or less degree of pigmentation, though in the Punjab where these examples were observed the skins are comparatively fair, and what is termed locally a 'wheat-coloured' complexion. All the cases reported for treatment for ophthalmological reasons. The appearance was very striking. The whole skin except the palms and soles was covered with fine dark spots varying in size from that of a pin-point to that of a match head. The lesions were most numerous on the face, but otherwise the distribution closely followed that given above. The faces all had a very black appearance, and this caused the sufferers to be very conspicuous. The skin looked as though it had been liberally sprayed with black paint by means of a paint sprayer. The colour varied from brownish black to jet black. Pigmentation occurred on the mucosa of the lips and faded out just inside the mouth. Lighter brownish irregular patches occurred in the conjunctiva around the limbus, but other mucous membranes appeared to be free from pigmentation. Telangiectasis was noted, but was not a prominent feature, except in one case. Neither were scalliness nor atrophic conditions at all prominent, but some atrophy was observed between the pigmented spots on the face. All the patients were practically blind, and this was due to what appeared to be a true keratitis of all the layers of the cornea. All the corneæ were white and opaque throughout, though the opacity was somewhat uneven. A few irregular blood vessels passed in from the periphery. Ulceration was noted but was inconspicuous and out of proportion to the degree of opacity, and this suggested that the changes probably depended on impaired nutrition. The lids were slightly thickened, but showed no deformity.

The condition appears to be associated with a striking tendency to malignancy. Out of three cases one had a melanoma of the eye and the

other a parotid tumour. The subjects were all of fair physical development and showed no evidence of any associated disease. There appeared to be no connection with syphilis, leprosy or malaria, and the eye lesions did not appear to be associated with trachoma which is very common in the locality.

*Ætiology.*—The disease is probably due to a congenital anomaly of the development of the papillary stratum, with associated defects in nutrition. Microscopic examination shows masses of pigment granules irregularly arranged in not only the superficial layers, but in the corium as well. It should be noted that a normal Indian skin contains no pigment in the corium. Some atrophy of the papillary layer is evident, but the prolongation of papillary pegs into the dermis and ectasia of the glands described by Kaposi was not observed. There were no significant changes in the blood films.

*Case 1.*—Mohammedan Jat female, aged 1½ years. The child was well built and active. The disease was first noted 4 months previously. The skin was covered with black spots and rosy telangiectases most numerous on the face, but otherwise on the whole body except the palms and soles, with a tendency to increased distribution on the neck, back, chest, shoulders and upper arms. The black spots were punctate and not raised but tended to be of larger size on the face. The right cornea was distinctly opaque, and the left was sufficiently hazy to prevent examination of the fundus. The child constantly squeezed the eyes, but appeared to have some useful vision. She had a tendency to hold the head to the left. The Wassermann test was negative and the blood showed no evidence of malaria and a normal cell count. No evidence of disease was detected in other systems.

*Case 2.*—Mohammedan Jat male, aged 3 years, brother of case 1. The condition was first noted 18 months previously. Fine black pigmentation covered the whole body except the palms and soles. It was very marked on the face and ears, and well marked on the upper part of the chest and back, neck, arms and thighs. Many of the spots on the face were the size of a match head or larger, though mostly not raised above the skin. Both corneæ were opaque and ulcerated and the child appeared to have perception of light only. There was a suggestion of proptosis of the right eye. There was weakness of the right facial musculature, and weakness of the left arm and leg. A tender nodule was observed in the right parotid gland and the mouth could not be widely opened. The blood showed a normal cell count, no malarial parasites, and a negative Wassermann test. Both eyelids were kept partly closed, though the lids themselves appeared healthy; other systems were normal and the child seemed intelligent. Exploration was refused.

*Case 3.*—J. U., Mohammedan Jat male, aged 18 years, of good physical development. Disease commenced in childhood. No family history of similar disease was obtained. Patient had two healthy brothers and one sister. The whole body except the palms and soles was covered with fine black or brownish black spots, mainly punctate, but up to the size of a match head. None were raised above the surface. The maximum distribution was seen on the face, but the shoulders, neck, upper parts of the chest and back, and the arms, especially the sides of the upper arms were heavily pigmented. The left cornea was opaque and the patient could see large moving objects only and the right cornea was replaced by a purplish fleshy tongue-like process, which projected between the lids. The right eye was excised and the tumour proved to be a melanoma, and black pigmentation was visible.

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## THYROID DRUGGING IN GRAVES' DISEASE

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GOITRE cases require full study and careful assessment before the line of treatment can be decided upon. Greatest caution should be taken while administering drugs like iodine and thyroid extract in these cases, for these drugs may serve as exciting causes of Graves' disease

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to the naked eye when the tumour was incised. Wassermann test was negative and blood cells normal and free from parasites.

A strange feature of this 'disease' is the tendency to occur in members of the same family, though it does not appear to be hereditary. Sequeira (1915) quotes an instance in which seven children in one family suffered from it. The cause is unknown and the reason for the tendency to malignancy is obscure. The influence of sunlight has been suggested as the cause, but this is not universally accepted. We are not aware that the incidence is higher in the tropics. The cases described all lived in a hot dry climate where the summer temperature ranges from 110°F. to 125°F. or more for several months. The prognosis is hopeless as most of the patients die in childhood or early adult life, usually from malignant disease.

Since the pathology of the condition is not understood, no rational treatment can be devised which might influence its progress. In the cases which came under our observation large doses of nicotinic acid and ascorbic acid were injected because the conventional diet in the district was known to be deficient in vitamins B and C. This was combined with arsenic, cod-liver oil, and hypophosphites together with oily applications to the skin. No effect whatever was observed. The treatment therefore can only be purely symptomatic and directed to preventing or arresting ophthalmic complications and prompt removal of malignancies as they appear.

### Summary

- (1) Three cases of xeroderma pigmentosum are described.
- (2) The differences between the disease as it occurs in eastern races and Europeans is pointed out.
- (3) Until the ætiology and pathology of the affection are understood, the affection presents a hopeless problem.

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in susceptible persons. In these circumstances, they may appear to serve the same function ætiologically as psychic trauma—the torch starting the conflagration in an inflammable subject. Cases have been recorded in which Graves' disease occurred shortly after the use of thyroid tablets taken for the purpose of overcoming obesity, or for an already existing slight hyperplasia of the thyroid, mistaken for simple compensatory enlargement. The following case of indiscriminate administration of thyroid tablets in a thyrotoxic subject leading to aggravation of the condition is reported:—

An Anglo-Indian married woman, 39 years of age, was admitted on the 27th July, 1940, exhibiting the typical signs of primary Graves' disease. The onset of symptoms was sudden. She was quite well until February the 16th, when she noticed the swelling in the neck for the first time. She herself thought it to be goitre, got very worried, and visited a doctor on the following day; he confirmed her diagnosis and prescribed a mixture, one ingredient of which was iodine, and thyroid tablets—one (she did not know the exact dose) to be taken daily before retiring. He also advised her to take simple food. She consulted him again on the 19th; her weight had gone down by five pounds in three days; she was then advised to take two tablets of thyroid daily. Next, she saw him on the 22nd; there was further reduction in weight and tablets were now increased to three a day. Her next visit was on the 27th; the weight dropped still further. She was given two bottles of medicine, and the tablets were increased to four a day. Her subsequent visit was on the 6th March, when the tablets were increased to five daily along with two bottles of medicine; this was continued till the 17th.

As she felt worse from day to day, lost weight progressively and felt very nervous and tremulous, while the goitre grew bigger, she discontinued the treatment and later consulted another doctor who prescribed Lugol's iodine and a bromide mixture. She felt a little better with this treatment, but the progress was rather slow.

Subsequently she consulted a doctor friend, who also prescribed Lugol's iodine. She took it for some time, but later she used to get sick with it and could hardly retain it. He then removed her to his own residence, kept her in bed, and consulted another doctor who prescribed a belladonna and bromide mixture. She picked up considerably and then returned to her own place and resumed household duties. Soon after she had a set-back and therefore sought admission into the Carmichael Hospital for Tropical Diseases.

On admission the patient complained of palpitation, nervousness, great loss of weight, disturbed sleep, fatigue, occasional diarrhoea, poor appetite, bulging eyes and goitre. She was carefully interrogated, but no psychic trauma could be elicited as the precipitating factor.

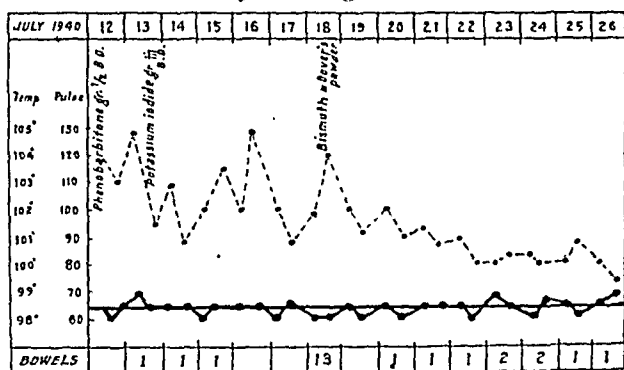
There was nothing particular with regard to her family and personal history.

**Physical examination.**—A thin under-nourished woman with a staring look; an average degree of exophthalmos with indefinite eye signs of Graves' syndrome; moderate-sized thyroid enlargement (maximum circumference of the neck—13½ inches) with smooth surface and definite systolic bruit; a rather excitable heart with a pulmonary systolic bruit; a collapsing type of pulse with a regular rate of 120 per minute; markedly pulsating abdominal aorta; fine tremor of the tongue and out-stretched fingers and moist warm palm. Her weight was 132 pounds; she had lost four stone in five months. The blood pressure was systolic 125 and diastolic 55 mm. of Hg., with a pulse pressure of 70. Following Read's formula— $0.75 (\text{pulse rate} + 0.74 \times \text{pulse pressure}) - 72$ —the basal metabolic rate was plus 56.8 per cent. The B. M. R. actually estimated by the Benedict-Roth metabolism apparatus was plus 50 per cent.

**Blood count.**—Haemoglobin 68 per cent = 9.35 grammes per 100 c.cm.; reticulocytes—0.2 per cent; red cells—3,620,000 per c.mm.; cell volume—30 per cent; mean corpuscular volume 83.3 cu  $\mu$ ; mean corpuscular haemoglobin 25.9  $\gamma\gamma$ ; mean corpuscular haemoglobin concentration 31 per cent; leucocytes—6,000 per c.mm.; polymorphonuclears—34 per cent; lymphocytes—55 per cent; large mononuclears—6 per cent; and eosinophils 5 per cent.

Van den Bergh test—negative.

Other laboratory findings are not relevant.



**Treatment.**—The patient was at once made a bed-case and put on phenobarbitone, grain ½ twice a day. Next day she was given potassium iodide, grains iii twice a day along with a high caloric diet. The iodide did not upset her in any way. After about a week while she was beginning to settle down, it was suggested that she might require an operation. This was enough to upset her nerves and caused severe diarrhoea—thirteen watery stools in twenty-four hours, which was readily controlled with two doses of bismuth and Dover's powder. The condition gradually improved and pulse came down to 72 per minute on the 15th day

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## SULPHATHIAZOLE IN SOME EXPERIMENTAL BACTERIAL AND VIRUS INFECTIONS

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THIS paper presents the results of testing sulphathiazole in experimental *Bacterium typhosum*, *Vibrio cholerae* and fixed-virus infections in mice, and vaccinia-virus infection in

(Continued from previous column)

although she had further lost in weight. Subsequently she agreed to be operated upon and was transferred to the surgeon for preparatory treatment and thyroidectomy.

### Summary and discussion

A woman, apparently with Graves' constitution, accidentally discovered one day that her thyroid was swollen. There was no obvious evidence of general or focal infection, or nervous shock that is usually regarded as the provocative factor in the causation of Graves' disease.

It is possible, there might have been psychic trauma which was difficult for the patient to recall to memory; or it might have been that she had undergone such a trauma but that its nature was distasteful to narrate. In the absence of careful psycho-analysis by experts no further light could be thrown on the subject.

Very likely the patient had the thyroid hyperplasia for some time before she happened to discover it, and she was obviously sensitive to the effects of thyroid, so that the condition was aggravated to a marked thyrotoxic state by its injudicious administration in increasing doses.

Discontinuation of the drug and treatment with rest, Lugol's iodine and sedatives improved her condition, but later she used to get sick with the iodine solution.

During a subsequent exacerbation she was admitted in the Carmichael Hospital for Tropical Diseases. The clinical picture has been described and the result of basal metabolic rate, as determined by Read's formula as well as gasometric method given. Blood count showed an increase in the percentage of lymphocytes.

Treatment consisted of bed-rest, potassium iodide in small doses (this was well tolerated by the patient), phenobarbitone and high caloric diet. The progress was satisfactory, and there was a steady improvement except one attack of typical nervous diarrhoea of thyrotoxic origin.

She was subsequently handed over to the surgeon.

### Acknowledgment

My grateful thanks are due to Dr. L. E. Napier for his kind permission to publish this note and for valuable suggestions.

rabbits. For comparative study sulphanilamide and sulphapyridine were also tested in some infections.

### *Bact. typhosum*

A strain isolated from blood of a severe case of typhoid was used. This organism, immediately after isolation, was not found to be very virulent for mice. After nine passages in mice it gained considerable virulence; 100 million organisms given intra-peritoneally produced death in 24 hours. The mice used in the experiments were of the Haffkine Institute in-bred strain, 6 weeks old, and weighing between 15 and 20 grammes. Older mice were found to be less susceptible to infection. For purposes of experiment, 100 million organisms from a 17-hour-old culture of the organism in ordinary nutrient broth were injected intra-peritoneally into mice. The drug under test was made into an emulsion in gum acacia so that 0.5 c.cm. of this emulsion contained the required amount of the drug. This quantity was fed to the mouse by means of a glass pipette introduced into its stomach. The results are shown in table I.

TABLE I

*The therapeutic effect of sulphanilamide, sulphapyridine and sulphathiazole in experimental Bact. typhosum infection in mice. The drugs were administered in 20 mg. doses soon after infection, 10 hours later and then twice daily for 3 more days*

Drug administered	Number of mice out of a group of 16 dying on each day after infection						Survivors	Average survival time (days: max. 10)
	1	2	3	4	5	6-10		
Sulphanilamide	4	..	..	..	..	..	12	7.5
Sulphapyridine	3	..	..	2	..	..	11	7.3
Sulphathiazole	2	1	..	2	..	..	11	7.3
Controls ..	16	..	..	..	..	..	0	0.0

### *V. cholerae*

An Inaba strain of *V. cholerae* was passed serially through 6-weeks-old mice until it was found to have acquired sufficient virulence for

mice. It was found that after eleven passages about 875 million vibrios killed mice in 24 hours. Further passages however did not enhance the virulence. For purposes of experiment 875 million vibrios from a 17-hour-old culture were injected intra-peritoneally into 6-weeks-old mice. The drug was administered as in the experiment with *Bact. typhosum*. The results are shown in table II.

TABLE II

*The therapeutic effect of sulphanilamide, sulphapyridine and sulphathiazole in experimental V. cholerae infection in mice. The drugs were administered in 30 mg. doses soon after infection and 10 hours later*

Drug administered	Number of mice out of a group of 12 dying on each day after infection						Survivors
	1	2	3	4	5	6-10	
Sulphanilamide	12	..	..	..	..	..	0
Sulphapyridine	12	..	..	..	..	..	0
Sulphathiazole	12	..	..	..	..	..	0
Controls ..	12	..	..	..	..	..	0

### *Bacteriostatic effect on V. cholerae*

In view of the absolute lack of therapeutic effect of the drug in *V. cholerae* infection, an 'in vitro' test was put up to ascertain if the drug possessed any bacteriostatic properties in relation to *V. cholerae*. A test with sulphanilamide was also put up for comparison. The results are shown in table III.

### *Fixed rabies virus*

The strain of fixed rabies virus (Paris strain) used in the routine manufacture of antirabic vaccine in this institute was used for purposes of infection. Three-weeks-old mice were used as they give uniform results. The minimum infective dose of the virus as determined by the method of Webster (1939) was 0.03 c.cm. of 1/160 dilution of the virus. The virus was diluted in 10 per cent horse serum in distilled water and 0.03 c.cm. of a 1/40 (representing four

TABLE III

*Bacteriostatic action of sulphanilamide and sulphathiazole on V. cholerae*

Drug	Number of organisms inoculated per c.cm.	Number of hours that elapsed between inoculation and appearance of growth in the various dilutions of the drug				
		1-2,500	1-5,000	1-10,000	1-20,000	1-30,000
Sulphanilamide .. ..	500	48	24	24	24	24
	5,000	48	24	24	24	24
Sulphathiazole .. ..	500	..	..	..	168	144
	5,000	..	..	120	96	48
Sulphathiazole + para-aminobenzoic acid ..	5,000	Not tried	Not tried	24	24	24

minimum infective doses) dilution of the virus was injected intramuscularly into the lower third of the gastrocnemius muscle of the mouse. Sulphathiazole was administered as in the previous experiments. The result was a complete failure of the drug in checking the fixed virus infection. All the mice died within 15 days of paralysis.

#### *Vaccinia virus*

Vaccine lymph obtained from the vaccine lymph institute at Belgaum and white rabbits weighing between 1.25 and 1.5 kg. were used in these experiments. The backs of the rabbits were shaved and about 0.1 c.cm. of vaccine lymph was smeared over the shaved surface which was then lightly 'scarified'. The drug was administered to one rabbit by mouth. Two received the solution of sodium salt of the drug parenterally and two served as controls. The results are shown in table IV.

TABLE IV

*The therapeutic effect of sulphathiazole in vaccinia virus infection in rabbit*

Weight of rabbit	Mode of treatment	Result
1.34 kg.	1 g. by mouth twice daily for 3 days.	Moderate 'take' after 72 hours.
1.32 kg.	0.375 g. (Na salt) intramuscularly twice daily for 3 days.	Do.
1.35 kg.	Do.	Do.
1.48 kg.	Control—not treated	Typical 'take' in 72 hours.
1.52 kg.	Do.	Do.

#### *Discussion*

Buttle *et al.* (1937) first reported that sulphanilamide, administered immediately after infection in single or repeated doses of 25 mg. protected a large percentage of mice against a moderate infecting dose of *Bact. typhosum*. Powell and Chen (1939) found that sulphanilamide in two doses of 5 mg. gave a good protection against 10 to 100 lethal doses of *Bact. typhosum*, while sulphapyridine under the same conditions gave inferior results. Kolmer and Rule (1939), who injected the above two drugs in doses of 0.160 g. per kg. body-weight, obtained only poor results, sulphapyridine being a little inferior to sulphanilamide. In our experiments (table I) there was no significant difference in therapeutic effect between sulphanilamide, sulphapyridine, and sulphathiazole. Though the protection given by these drugs in this experimental infection cannot be considered to be as spectacular as that obtained in the case of streptococcal or pneumococcal infections, the results are striking enough to justify a careful clinical trial with these drugs. The clinical data reported so far contain some favourable reports of treatment

with prontosil, sulphanilamide, and sulphapyridine in typhoid fever, persistent typhoid bacilluria and pyelitis, typhoid caries, etc., and also a few unfavourable ones; but these are too scanty to admit of a proper evaluation of the efficacy of these drugs in this infection (*cf.* Buttle, 1939; Kolmer, 1940). Very recently, good results are reported by Weilbaecher *et al.* (1940) in 3 of 4 patients treated with sulphathiazole. To obtain the best results, it is important that the treatment with these drugs should be instituted as early as possible and an adequate blood concentration of about 5 mg. per cent of the drugs maintained throughout the course of the infection.

Table II clearly shows sulphanilamide, sulphapyridine or sulphathiazole to be of no value in cholera. This negative result is of interest in evaluating the validity of some of the theories proposed regarding the mechanism of action of this class of drugs. Locke and Mellon (Mellon *et al.*, 1940) have advanced the anti-catalase theory which postulates that the therapeutic effect of the sulphanilamides is due to the injury caused to the organisms by hydrogen peroxide accumulated at the focus of infection as a result of the inactivation of the enzyme, catalase, by the drug. This theory requires that the organisms which produce catalase and are sensitive to injury by hydrogen peroxide should, as a class, be amenable to treatment by these sulphanilamides. But the case of *V. cholera* apparently throws doubt on the validity of this theory for this microbe has been shown by McLeod and Gordon (1923) to be markedly sensitive to hydrogen peroxide and also to produce catalase though to a small extent. Recently, Woods (1940) and Fildes (1940) have advanced the theory that the sulphanilamides act by inhibiting the action of an enzyme of some fundamental importance by competing with its substrate which is an 'essential metabolite' surmised to be *para*-aminobenzoic acid. According to this theory, the sensitiveness of a microbe to sulphanilamide would depend upon whether it could synthesize this substrate readily or not, *i.e.*, a microbe that is not sensitive to the drug should be able to synthesize *para*-aminobenzoic acid in excess to overcome the inhibition by sulphanilamide. In the case of *V. cholera*, we find a marked discrepancy between the *in vivo* and the *in vitro* results. As shown in table II, sulphathiazole shows absolutely no protective power against this micro-organism in mice. But *in vitro*, this drug possesses a striking bacteriostatic effect even in a dilution of 1 : 30,000 and this action is reversed by the addition of *para*-aminobenzoic acid, which by itself possesses no perceptible growth-stimulating effect on *V. cholera*. This behaviour of the organism *in vitro* is not distinguishable from that of the streptococci or pneumococci, both of which respond to treatment with sulphathiazole. It is difficult to reconcile this difference in behaviour of sulphathiazole towards *V. cholera* between

the *in vivo* and *in vitro* experiments, in the light of the theory of Woods and Fildes unless one assumes that this organism produces *para*-aminobenzoic acid in excess *in vivo*, while it is not able to do so *in vitro*. It is doubtful whether this is the case and further experiments are in progress to examine this question.

Till now, the action of the sulphanilamides have not been tested in experimental vaccinia virus infections but there are a few instances on record (McCammon, 1939; King and de Rozario, 1938) of the beneficial effects of prontosil and sulphanilamide in smallpox. The results recorded in table IV indicate that the drugs do not possess any specific therapeutic effect against this virus and obviously the above-mentioned favourable clinical results are due to the prevention of the secondary streptococcal infection of the lesions by these drugs. The sulphanilamide derivatives may thus be of use in smallpox, if at all, only in this direction.

The action of sulphanilamide and some of its derivatives in experimental rabies infections have previously been reported. Kirk (1939) has found 'prontosil' to have no effect on rabies of rabbits. McCrea (1939) has reported that sodium sulphanilyl-sulphanilate prevented the development of rabies in one-third of the number of rabbits; this result does not appear to be very definite. Gross, Cooper and Lewis (1939) have found only a very slight prolongation in life of rats infected with the virus when treated with sulphanilamide or sodium sulphanilyl-sulphanilate. Powell and Chen (*loc. cit.*) have declared sulphanilamide and sulphapyridine to be of no value in rabies in mice. Our results show that sulphapyridine and sulphathiazole also are of very little value in rabies of mice.

### Summary

1. The therapeutic value of sulphathiazole in experimental *Bact. typhosum*, *V. cholerae* and fixed rabies virus infection in mice and vaccinia virus infection in rabbits has been investigated.

2. Experimental results show that the drug has appreciable therapeutic effect in experimental *Bact. typhosum* infection in mice and is of no therapeutic value in experimental *V. cholerae* and fixed rabies virus infection in mice and vaccinia virus infection in rabbits.

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## AGES OF EPIPHYSIAL UNION AT ELBOW AND WRIST JOINTS AMONGST 238 CHILDREN IN NORTH WEST FRONTIER PROVINCE

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VERY frequently doctors are called upon to give an opinion as to the age of a person, either for medico-legal purposes, for entry to government service, or to enable a candidate to sit for university examinations, etc.

The registration of births is still extremely incomplete in India, even in municipal areas.

In January 1939, Colonel R. S. Townsend, gave us a copy of a paper written by himself and Rai Bahadur Dr. Raghunandan Lall, M.B., B.S., on age determination of Indian girls in the United Provinces by x-ray demonstration of epiphysial union.

His paper was published in the *Indian Medical Gazette*, October 1939.

The present paper is a continuation of his work. He obtained from the Provincial Government a grant of Rs. 200 for this purpose and this investigation owes its inception to his enthusiasm and interest.

The requisite number of boys and girls could not have been obtained without the support of Miss Littlewood, inspectress of girls' schools, N. W. F. P., and the hearty co-operation of the head-mistresses and head-masters of schools in Peshawar, to all of whom we acknowledge our debt of gratitude.

The first problem was to collect an adequate number of scholars whose ages could be proved to be between 13 and 20.

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We appealed to all the schools in Peshawar and found that there were 788 boys and 200 girls on their registers whose official ages were recorded as between 15 and 19.

The school medical officers, Dr. Mohamad Shah, Dr. Shuaib, and Dr. (Miss) Mubarak Jan, carried out a long and conscientious investigation into the proof of age of all these children.

After consulting birth registers, municipal records, horoscopes, and so on, we were finally left with 189 boys and 49 girls whose ages were proved.

Out of nearly 1,000 scholars, only 238 could really prove their age.

The procedure was as follows :—

We decided to limit our investigation to the epiphyses around elbow and wrist joints for the following reasons :—

(a) To keep the cost within the available grant.

Very early we learnt that it was impossible to get an accurate antero-posterior view of the epiphyses at the upper end of the ulna as it was hidden by the lower end of the humerus and the x-ray was oblique to the epiphysal line. In the following table therefore this epiphysis has been ignored.

We have considered union complete if (i) bony structure was continuous between diaphysis and epiphysis, or (ii) if the epiphysal line was completely replaced by a thin line of dense bone. All films were examined with a strong convex lens to decide these points.

The scholars have been grouped into age groups as follows :—

13-14, 14-15, 15-16, 16-17, 17-18, 18-19, 19-20; boys and girls separately. The percentages of union of each epiphysis in each age group and either sex are shown in the following tables :—

*Boys total 189*

Age group	Number in group	RADIUS		Ulna, lower end	HUMERUS		Base, first metacarpal
		Upper	Lower		Lateral	Medial	
		ends			condyle		
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
13-14	10	0	0	0	50	10	0
14-15	22	19	0	0	60	18	0
15-16	67	22	1½	6	80	25	3
16-17	48	33	4	6	98	42	12
17-18	24	86	25	40	100	90	53
18-19	8	88	40	62	100	88	62
19-20	10	100	40	50	100	100	90

*Girls total 49*

13-14	3	0	0	0	33	0	0
14-15	10	70	20	40	90	70	0
15-16	7	85	30	30	85	70	14
16-17	9	100	33	55	100	88	33
17-18	10	90	50	60	100	100	70
18-19	5	100	60	60	100	100	80
19-20	5	100	80	80	100	100	80

(b) To avoid difficulty which would have arisen if we had tried to undress the girls for x-ray of hip and knee. Even strictly purdah girls raised no objection to exhibiting an arm from under the *burqa*.

We used Agfa x-ray sensitive paper 15 inches × 12 inches as cheaper than film, and not so much affected by the hot weather. Each sheet was large enough to radiograph the elbows and wrists of four subjects.

Six dozen papers sufficed for the 238 children.

The details of each child were entered on an index card which was numbered and the same number radiographed on to the sensitive paper. A specimen of the card used is in the protocol (p. 84). Great care was taken to centre the central ray in every case.

The numbers are of course too small for statistical treatment and the mathematical margin of error must be very high. But, as far as they go, they suggest that in more than 50 per cent of cases each epiphysis will be found united at the following ages for children in the North West Frontier Province.

The average age for European and American children has been taken from Shanks, Kerley and Twining's *Textbook of X-ray Diagnosis* where the findings of many authors have been collected.

Our findings support the view that epiphysal union takes place earlier in India than in Europe.

In girls union appears to take place earlier than in boys; in some epiphyses as much as two years earlier.



In collecting data of our 238 children we took notes on the number of teeth and age at onset

Epiphysis	AGE OF UNION		Average age of union in European and American children of both sexes
	Boy	Girl	
Radius, upper ..	17-18	14-15	16-19
Radius, lower ..	Above 20	18-19	20
Ulna, lower ..	18-19	16-17	20
Humerus, lateral condyle	14-15	14-15	17-18
Humerus, medial condyle.	17-18	14-15	18
First metacarpal base ..	17-18	17-18	18-20

of menses. Our findings under these heads were as follows :—

appear to get their wisdom teeth later than boys, although their epiphyses unite earlier.

In the absence of x-ray the teeth are widely used to base the estimate of age, but the above tables suggest that the number of teeth present is a very unreliable evidence as to age.

Of the 49 girls included in our investigation 47 had started menstruation.

The ages at which these 47 girls started menstruation were :—

At age 11 years	2 per cent	} By age 14, 54 per cent had menstruated.
12 "	6 "	
13 "	25 "	
14 "	21 "	
15 "	21 "	} By age 15, 75 per cent had menstruated.
16 "	17 "	
17 "	6 "	

These figures show that 46 per cent had not menstruated till after 14th year, as compared with Colonel Townsend's figure of 14 per cent

### Boys

Age group	Number in group	Less than 28 teeth.	28 teeth	More than 28 teeth	
		Per cent	Per cent	Per cent	
13-14	10	0	80	20	} Of 147 boys below age 17 years, 28 (19 per cent) only had more than 28 teeth.
14-15	22	8	87	5	
15-16	67	4	72	24	
16-17	48	3	79	18	
17-18	24	1	50	49	} Of 42 boys above 17 years, 18 (43 per cent) had more than 28 teeth.
18-19	8	14	62	24	
19-20	10	0	60	40	

### Girls

Age group	Number in group	Less than 28 teeth.	28 teeth	More than 28 teeth	
13-14	3	33	66	0	} Of 29 girls below 17, only one (3 per cent) had more than 28 teeth.
14-15	10	0	100	0	
15-16	7	15	85	0	
16-17	9	11	77	11	
17-18	10	10	60	30	} Of 20 girls above 17, 7 (35 per cent) had more than 28 teeth.
18-19	5	0	60	40	
19-20	5	0	60	40	

The detailed number of teeth in each group was as follows :—

### Boys

Age group	Teeth 27	28	29	30	31	32
13-14	0	8	1	0	0	1
14-15	2	19	1	0	0	0
15-16	2	48	7	5	2	3
16-17	2	38	3	2	0	3
17-18	0	12	2	4	5	1
18-19	1	5	0	1	0	1
19-20	0	6	0	1	3	0

### Girls

Age group	Teeth 27	28	29	30	31	32
13-14	1	2	0	0	0	0
14-15	0	10	0	0	0	0
15-16	1	6	0	0	0	0
16-17	1	7	0	0	0	1
17-18	1	6	0	1	2	0
18-19	0	3	0	1	1	0
19-20	0	3	0	0	1	1

These tables regarding the eruption of teeth are interesting and show how very variable are the ages at which the teeth appear. The girls

and 25 per cent had still not menstruated at end of 15th year. Colonel Townsend's figure is 3 per cent.

Perhaps the later age of menstruation in the North West Frontier Province compared with the United Provinces is connected with the long cold weather here, more comparable to the European climate.

It is clear that an opinion as to the age of any adolescent cannot be given with great accuracy, even after consideration of the state of union of six epiphyses *plus* teeth *plus* date of menstruation. Any opinion must leave a margin of about six months older or younger than age given.

Before giving an opinion as to age in any medico-legal case we now complete the form shown in the protocol. This seems helpful in framing the opinion and also gives the support of facts and figures which is of assistance in maintaining the opinion given when opposed by counsel in court.

(Continued at foot of next page)

## THE PRESENCE OF AN ENZOOTIC OF RICKETTSIAL INFECTION IN WILD RATS OF CALCUTTA

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M.R.C.S., F.R.S.E.

(From the School of Tropical Medicine, Calcutta)

COVELL (1936) drew attention to the existence of typhus infection in the wild rats of Simla Hills, and considered that these rodents acted as reservoirs of the infective agent for the spread of typhus fever. Cases of typical typhus fever are rare in Calcutta, but there is a possibility of the presence of mild and atypical cases which are not diagnosed correctly. Lepine and Bilfinger (1934) and Nicolle and Sparrow (1934) have described strains of typhus of feeble virulence. Typhus infection in wild rats, in the absence of any cases of the disease in human beings, has been reported. In view of these findings we determined the presence and nature of rickettsial infection in the local rodents.

A number of rats (*Rattus norvegicus*) caught in certain parts of Calcutta were examined as follows:—

The rats were killed by drowning and the brains were removed with sterile precautions and a saline suspension of the brain was injected intra-peritoneally into one or more male guinea-pigs. In a number of experiments, a variable number of the inoculated guinea-pigs died within 24 hours. Although the brains were removed with great care, still a number of organisms

were found to be present; they will be referred to later. In view of the presence of the secondary bacterial infection in certain rats, the technique was modified. The brains were kept in the refrigerator and the bacterial purity was controlled by broth culture; only bacteria-free brains were used for guinea-pig inoculation. The temperature of the guinea-pigs was recorded every morning and those showing definitely a febrile reaction on more than one day were sacrificed and their viscera examined. Covell (*loc. cit.*) found that the rise of temperature was generally up to 103°F., rarely exceeding 104°F., after the infection, and during the first four passages it was unusual for the pyrexia to persist for more than 3 or 4 days, but in later passages it continued for 10 to 12 days on several occasions. We had different experience in Calcutta. The stock guinea-pigs had a temperature range of 102°F. to 103.6°F., the temperature occasionally rose to 104.2°F. and very rarely reached 105°F. The thermometer was pushed up to two inches from the anal aperture to get this temperature. The temperature was lower by 0.5°F. to 1°F. when the mercury bulb was just introduced into the anal canal. These figures relate to the temperature taken in summer months between 10 a.m. and 10-30 a.m.; there was a rise of temperature of about 0.5°F. by 11-30 a.m. The range of temperature was lower in winter months, *i.e.*, 100.4°F. to 102.4°F., occasionally going up to 103°F.

One hundred and one rats caught in certain areas of Calcutta were examined; the results were as follows:—

(Continued from previous page)

### PROTOCOL Form for age computation

Boy  
Girl

Name .....  
Father's name .....  
Address .....

Marks of identification (1)  
(2)

- I. Age by appearance and general development
- II. Number of teeth ..... age .....
- III. Date of onset of menstruation ..... age .....
- IV. X-ray:—

Epiphysis	AGE OF UNION		United or not	Balance of age by x-ray
	Boys	Girls		
Radius, upper end	17-18	14-15		
Radius, lower end	Above 20	18-19		
Ulna, lower end	18-19	16-17		
Humerus, lateral condyle.	14-15	14-15		
Humerus, medial condyle.	17-18	14-15		
Base of 1st meta-carpal.	17-18	17-18		
Probable age			Final opinion is —	

Area	Number of rats examined	Number positive	Number negative
Kidderpore ..	68	60	8
Burra Bazar ..	16	10	6
Tropical School	17	2	15
TOTAL ..	101	72	29

The guinea-pigs showing a mild febrile reaction and slight thickening and congestion of the tunica vaginalis after an incubation period of 4 to 21 days were considered to be positive. The rise of temperature was from 1°F. to 3.6°F., fever lasted generally from 3 to 4 days, but was present irregularly in some cases up to at least three weeks. Smears taken from the tunica vaginalis, spleen, and brain, and stained with dilute Giemsa's stain for 18 hours at 37°C., showed the presence of rickettsial bodies both intra-cellular and extra-cellular. They were pleomorphic, varying from minute coccid forms to moderately long bacillary forms. The infection was passaged from one guinea-pig to another but tended to become attenuated. Bacteria-free suspensions of tunica vaginalis inoculated on the chorio-allantoic membranes

of growing chick-embryos produced well-defined whitish patches in 2 to 4 days. A suspension of the infected membranes definitely reproduced the disease in male guinea-pigs.

Congestion and patchy necrosis of the scrotum were observed only in one case, but the inoculation of the suspension of the tunica vaginalis failed to reproduce the scrotal reaction; the tunica vaginalis was found to be thickened and congested.

Having demonstrated the presence of a rickettsial infection in the wild rats of Calcutta, the Weil-Felix reaction of the serum of infected guinea-pigs was investigated. Blood was drawn before the animals were infected and in various stages of infection. A certain number of other normal guinea-pigs were tested at the same time as controls.

The final dilutions of the serum put up were: 1/25, 1/50, 1/100, 1/200 and so on. The proteus strains used were HX19, HXK and HX2, and the O suspensions prepared therefrom were used. The results are as follows:—

1/25 with OX19 and OX2, there was no rise of agglutinins after more injections. These findings suggested either that the local rickettsial strain had no relationship to any of the three strains of the proteus group or that a fourth strain was at work. In view of the absence of reported cases of clinical typhus fever in Calcutta, we examined the sera of 100 cases of obscure fevers for proteus agglutinins; none of the sera agglutinated the OXK, OX19 and OX2 suspensions in high dilutions. It could be concluded that the rat strain was probably non-pathogenic to man. An emulsion of spleen and tunica vaginalis from two febrile guinea-pigs was injected subcutaneously into a volunteer; no untoward symptoms developed over a period of three months. A second volunteer injected with similar material remained well for a week, but could not be traced later. It can be inferred from all the data available that the rat strain is probably non-pathogenic to man.

Our attention was next directed to the presence of rickettsiae pathogenic to guinea-pigs and

*Weil-Felix reaction performed with the sera of normal and infected guinea-pigs*

NORMAL GUINEA-PIG SERUM				INFECTED GUINEA-PIG SERUM			
Number of sera tested	Dilution of serum positive			Number of sera tested	Dilution of serum positive		
	OX19	OXK	OX2		OX19	OXK	OX2
11	0	0	0	5	0	0	0
4	0	1/25	0	2	0	1/25	0
1	1/25	0	0	1	1/25	0	0
12	1/25	1/25	0	6	1/25	1/25	0
4	1/25	1/50	0	4	1/25	1/50	0
				3	0	1/50	0
4	1/50	1/50	0	1	1/50	1/25	1/50
1	1/50	1/25	1/25	4	1/50	1/50	0
3	1/50	1/50	0	3	1/25	1/100	0
1	1/50	1/50	1/25	2	1/50	1/100	0
41	..	..	..	31	..	..	..

Thirty-one guinea-pigs were tested for the presence of proteus agglutinins when the temperature was coming down or in late convalescence. There was no appreciable rise of agglutinins as compared with 41 normal guinea-pigs. The highest titre was 1/50 with OX19, 1/100 with OXK and 1/50 with OX2. As there is no rise in proteus agglutinins in guinea-pigs infected with the louse-borne typhus, much significance cannot be attached to this observation.

It was essential to immunize some other animals to demonstrate the proteus relationship of the rickettsial bodies. Six rabbits were given intra-peritoneal injections of suspensions of rat brains in gradually increasing doses of 1 to 10 c.cm. The highest titre obtained after a few injections was 1/50 with OXK suspension and

monkeys in the bodies of ticks. A large number of specimens of *R. sanguineus* and *A. persicus* were collected for us by Drs. D. N. Roy and B. C. Basu. About a dozen were examined each time; they were ground up in sterile saline and treated with ether for at least four hours to diminish appreciably the number of bacteria present. An intra-peritoneal inoculation into guinea-pigs and an intradermal injection into monkeys failed to produce any untoward symptoms. The same technique was employed in the examination of bed-bugs, lice, and fleas with negative results in each case.

The local rat strain was next compared with a definitely pathogenic rickettsial strain. For this purpose the XK strain from Kasauli was obtained through the courtesy of Dr. R. O. A.

Smith. It produced marked peritoneal effusion and enlargement of spleen in inoculated guinea-pigs, unlike the reactions produced by the local strain. In a preliminary series of experiments there was some evidence that the local strain was antigenically different from the Kasauli strain.

Lepine and Bilfinger (*loc. cit.*) reported that, although they obtained the rickettsial strain from a large percentage of rats at one season of the year, only two strains were isolated from 475 brains at a later date. We were able to isolate rickettsiae from most of the wild rats from June 1937 to December 1938. But we have failed to get any positive results from September 1939 to July 1940, although 335 rats dead for a few hours have been examined. All the inoculated guinea-pigs in the second series of experiments were receiving a diet of bran and gram which is deficient in vitamins; still we did not get any febrile reaction. It is clear that we were previously dealing with an enzootic of typhus fever in the wild rats of Kidderpore area which later died out.

The organisms isolated from the 335 rats were studied with a view to finding the nature of concomitant organisms in the brains of wild rats. The following organisms were isolated from the brains examined:—

<i>B. proteus</i>	..	..	10 cases.
Coliform bacilli	..	..	49 "
<i>B. pyocyaneus</i>	..	..	62 "
<i>Strep. viridans</i>	..	..	23 "
<i>Micrococcus catarrhalis</i>	..	..	2 "

None of the proteus strains isolated agglutinated with any of the OX19, OXK, or OX2 suspensions. Out of the 49 coli form strains, 22 fermented lactose with the production of acid and gas, the other 27 strains were non-lactose fermenters giving mostly atypical sugar reactions. None of the strains was agglutinated by a mixed salmonella serum and a majority of them tested with the Shiga serum gave negative results. Three strains gave the biochemical reactions of *B. metadysenteriae* C, *B. ceylonensis* B, and *S. paradysenteriae* (Flexner).

#### Summary

An enzootic of typhus fever has been described in wild rats of Calcutta; this rat strain was most probably non-pathogenic to man.

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## THE EFFECT OF STOCKING RICE FIELDS WITH SULLAGE AT KHURDA ROAD ON ANOPHELINE BREEDING\*

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WHILE writing a report on 'The present use of naturalistic measures in the control of malaria', Hackett, Russell, Scharff and Senior White (1938) found that there was a difference of opinion among themselves as to the effect of rotting stubble in water in rice fields after reaping. Therefore, Senior White asked all the malaria inspectors working under him, including the present writer, to select a typical field, to rot stubble in it as soon as possible after the harvest, and to study the effects in the subsequent rice-growing season in comparison with another typical field not so treated.

The value of naturalistic methods in rice fields cannot be over-estimated. There are several areas in this country where rice fields breed the local vectors in large numbers. Rice fields situated along foot-hills and tapping seepages have been shown to breed *Anopheles fluviatilis*, *A. minimus* and *A. varuna*, in the Jeypore hills (Mandal, 1938). Venkat Rao (1938) has shown that *A. annularis*, the main vector in the Orissa coastal plains†, breeds in significant numbers in all rice fields at Khurda Road. On account of their extent, they are costly to deal with. They cannot be effectively drained away in those large areas 'where the flooding of rice is entirely dependent on an intermittent seasonal rainfall' (Hackett *et al.*, 1938). Therefore, any anti-larval measures which do away with chemical larvicides and which do not interfere with the irrigation of the fields are to be welcomed.

The present writer has made the study suggested, at Khurda Road in Orissa where, owing to the practical elimination of other types of breeding places, rice fields constitute almost the sole breeding place of the local vectors. He, however, observed that, after harvest, practically no stubble was left in the fields and that the little that remained would not, even after rotting, show any substantial difference in the fauna. He, therefore, decided instead to stock the fields with crude sullage, as another form of rotting, throughout the dry season and to study the effects in the next rice-growing season.

The *ryots* at Khurda Road did not offer obstruction to this method. They even welcomed it as it would enable them to plough the fields easily in the dry season, when, otherwise, the ground would be too hard for ploughing.

The sullage from the railway colony at Khurda Road station was utilized for this purpose. The main outfall drain empties itself into a *kutchha*

\* A summary of this paper was read by the writer before the Fifth Annual Conference of the B. N. Railway Malaria Inspectors held at Dongargarh (Central Provinces) in March 1940.

† Proof of this will be furnished by Senior White and Adhikari in a paper still under preparation.

drain, which passes through a large number of rice fields and is finally led into the Daya river, one of the branches of the Mahanadi. During the season favourable to the breeding of *C. fatigans* (December to March) this drain is regularly cleaned and oiled by the sanitary staff of the railway in order to prevent mosquito nuisance and the spread of filariasis. This does not, however, prevent the *ryots* from diverting the sullage into their fields during the dry season to facilitate ploughing. When they take the sullage, they do not take the small quantity sufficient for wetting the soil but try to allow as much sullage as possible to run into the fields and thus convert each field into a sullage swamp, breeding *C. fatigans* in large numbers. Oiling such swamps is both costly and inefficient.

One field situated close to the main sullage outfall drain was selected for the experiment and another field in the same area, which was of nearly the same size, was selected as 'control'. Sullage from the main drain was let into the experimental field on one day each week. As soon as a depth of half an inch was obtained, the sullage flow was cut off and diverted again into its normal course. Usually, in the dry months (March to June) when this experiment was done, the field became dry in 24 to 36 hours. There was, therefore, no danger of the field being converted into a sullage swamp, breeding *C. fatigans* heavily. The field was ploughed when dry by the *ryot* about once in a month in this period.

At the beginning of the rains, the *ryot* sowed rice seeds in the field. In this part of Orissa, the rice is 'broadcast' in the fields and not 'transplanted'. The field was never dried till harvesting and the depth of water in it varied from one inch to three inches. The field was irrigated with rain water only, there being no seepages in it. The 'control' field also satisfied the same conditions, except that no sullage was allowed to run into it at any time during the previous dry season.

Larval sampling was made in both the fields from 1st July, 1939 to 31st December, 1939, by the same man throughout. The sampling was made by making a total of 25 ladle dips in each field once a week. The dips were made mostly at the edges but a few were made also as far inside the field as the *ryot* would allow us to proceed while the rice was growing. Neither this nor larval estimation by dipping are claimed to be satisfactory methods but they were adopted for want of better methods.

The larvae collected each month from the experimental field (which was 'treated' with sullage as described above) are shown in table I.

The larvae collected from the 'control' field (which was not 'treated' with sullage) are shown in table II.

#### Discussion

The first four species are definitely not carriers. There is evidence to show that

TABLE I

Month	<i>A. barbirostris</i>	<i>A. hyrcanus</i>	<i>A. subpictus</i>	<i>A. vagus</i>	<i>A. culicifacies</i>	<i>A. annularis</i>	<i>A. aconitus</i>	<i>A. varuna</i>
July ..	..	..	43	17	..	..	..	..
August ..	..	..	48	32	..	2	..	..
September ..	..	..	130	47	..	..	..	..
October ..	..	..	47	41	..	..	..	..
November ..	..	..	7	39	1	..	..	..
December ..	..	..	..	..	..	..	..	..
TOTAL ..	..	..	275	176	1	2	..	..

TABLE II

Month	<i>A. barbirostris</i>	<i>A. hyrcanus</i>	<i>A. subpictus</i>	<i>A. vagus</i>	<i>A. culicifacies</i>	<i>A. annularis</i>	<i>A. aconitus</i>	<i>A. varuna</i>
July ..	..	..	35	28	..	..	..	..
August ..	..	3	37	2	7	6	..	..
September ..	..	4	56	1	2	11	..	..
October ..	..	51	17	1	14	75	16	..
November ..	1	40	18	8	..	43	26	4
December ..	20	19	17	43	4	4	28	3
TOTAL ..	21	117	175	83	27	139	70	7

*A. culicifacies* is not a carrier in this area (Senior White, 1936 and 1937). *A. annularis* is proved to be a carrier at Khurda Road (Sarathy, 1932), while *A. aconitus* was found infective at Dhanmandal and Malatipatpur, two endemic stations, 100 miles north and 22 miles south of Khurda Road, respectively. *A. varuna* has so far been found to be a carrier in Jeypore hills (Senior White, 1936 and 1937), in the Central Provinces (Senior White, MSS.), in Chota Nagpur (Senior White and Das, 1938) and in Bengal (Iyengar, 1934, and Roy, 1938).

The above tables show that, in the 'treated' field, there is a marked increase of non-carriers (this does not, however, apply to *A. barbirostris* and *A. hyrcanus* which appear to prefer clean waters) and a very substantial reduction in carriers, while the 'untreated' field breeds both the carriers and non-carriers freely.

This experiment also shows that (1) allowing sullage into the rice fields might be a satisfactory method of sullage disposal in rural areas, where no other method is available or practicable; (2) *C. fatigans* can be controlled without the use of oil; and (3) filariasis, which is widely prevalent in this area, can be checked. Whether the addition of sullage to the field, which is not otherwise well manured, has also the effect of improving the crop could not, of course, be studied by the writer.

It might be said that this experiment was carried out in an area adjacent to a railway colony which represents urban, and not rural, conditions. The writer admits the force of this argument. He would, however, like to point out that Khurda Road station has a population of about 3,500 only and is situated in typical rural surroundings. In villages having about the same population, sullage accumulates near houses or is allowed to run to waste and, in any case, it is not only not disposed of in a proper manner but is allowed to become a positive nuisance. The method advocated in this paper would be found applicable to such cases.

The writer is aware that this experiment carried out in one field, and in one season, cannot prove anything conclusively and can at best indicate the possibilities of this form of naturalistic measures. In order to obtain more comparable results and to see if, by this treatment, the crop can be improved, a further experiment on a much larger scale is proposed to be carried out at the same station in 1941 by the writer with the co-operation of Mr. P. D. Dixit, M.Sc., paddy specialist, Orissa, Dr. R. G. Panigrahi, M.B.B.S., D.P.H., malaria officer, Orissa, and Mr. V. Ramakrishna, B.Sc., assistant malaria inspector, B. N. Railway.

#### Summary

(a) Allowing sullage into rice fields in the dry season once a week without converting the fields into sullage swamps has the effect of increasing the breeding of non-carrier anopheles and greatly decreasing the breeding of carriers, besides indicating a method whereby *C. fatigans*, and with it filariasis, can be controlled.

(b) Whether the same procedure has the effect of improving the crop is not yet ascertained.

#### Acknowledgment

The writer is grateful to Dr. R. Senior White, F.R.S.E., Malariologist, B. N. Railway, for the guidance and encouragement he gave throughout the period of investigation.

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## A SIMPLE METHOD OF OBTAINING ANÆROBIOSIS

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THE well-known principle of removal of oxygen during the rusting of iron is utilized for producing anærobiosis. Any container capable of being hermetically sealed can be used, one of the usual desiccators with a stopcock or an improvised apparatus such as a screw-cap fruit jar or an ordinary glass tumbler covered with a glass plate (a petri-dish cover serves the purpose well), and made air tight with plasticine or other suitable plastic material, gives entirely satisfactory results. Some moistened iron filings are placed at the bottom of the jar, one of the usual oxygen indicators (for example, alkaline-glucose-methylene-blue mixture) placed along with the cultures, and the jar sealed. After 6 to 12 hours, according to the size of the jar and the amount and quality of iron filings, the colour of the indicator is discharged and complete anærobiosis obtained. Approximately 60 grammes of iron filings are sufficient to produce complete anærobiosis overnight in a container of about 1,000 c.cm. capacity. Smaller amounts of iron filings take longer time.

This method of producing anærobiosis is efficient. Cultures of strict anærobes both in liquid media and on surface agar can be easily obtained. Compared with parallel inoculations incubated in McIntosh and Fildes' jar, employing the standard technique of producing anærobiosis, there is no appreciable difference in cultures made in liquid medium, but there is a difference in the amount of growth on solid medium. This difference is however of not any practical importance. The test organisms used were *Clostridium tetani*, *Cl. histolyticum* and *Cl. botulinum*. When comparatively clean iron filings are used there is no detectable amount of hydrogen sulphide produced (using lead acetate papers as indicators).

There is, as will be readily appreciated, a reduction in the tension inside the jar. This can be readily demonstrated by opening the jar with the opening immersed in water when water to about 1/5th the volume of the jar will flow in. This reduction in pressure has certain advantages in that, provided the seal is efficient, the atmospheric pressure will tend to keep the jar well sealed. If however it is desired to equalize the pressure, then a neutral gas (such as nitrogen, hydrogen, or CO<sub>2</sub>) can be admitted after anærobiosis has been obtained. Where facilities are available the jar can be evacuated and hydrogen admitted, but comparative tests

with this method and without any preliminary evacuation have shown no real advantage. The resulting growth is approximately the same.

Another very great advantage of this method of producing anaerobiosis is that the jar can be opened as often as desired to examine the cultures, and closed again. The partially-oxidized iron filings appear to be more active than new filings.

Many other uses of iron filings for producing anaerobiosis will suggest themselves. Some of the methods tried and found to give satisfactory results are :—

(1) Sterile iron filings in a flat screw-capped bottle can be used to produce anaerobiosis to allow the growth of strict anaerobes on surface agar in that bottle. Liquid cultures can be obtained if the iron filings are contained in an enclosed small test-tube.

(2) Used at the bottom of an agar deep, the resulting anaerobic condition is more satisfactory than with the usual glucose agar.

(3) Used at the bottom of a broth tube in place of cooked meat in cooked-meat broth.

(4) Used on top of a pushed-in cotton-wool plug and the test-tube then sealed with a rubber cap. Complete anaerobiosis is obtained in a few hours.

### Summary

An anaerobic method is described based on the well-known principle of oxidation of iron filings. The method is simple and efficient. No expensive and complicated equipment is required. There is no need for a hydrogen cylinder or a generator for hydrogen, vacuum pump, or for any one of the devices of palladized asbestos wool. In the trials carried out this method has given satisfactory results.

## A Mirror of Hospital Practice

### A CASE OF PLAGUE SUCCESSFULLY TREATED WITH SULPHAPYRIDINE

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CASES of plague are admitted from time to time to the Campbell Medical School and Hospital. Two such cases were admitted during 1939, and were under the care of one of us (B. C. C.). No anti-plague serum was available so that treatment by other agents had to be resorted to. The first case, admitted early in the year, was treated with iodine intravenously, and died on the third day of her stay in hospital. The second case, which forms the subject of this report, was that of a female child aged 6 years who was admitted with symptoms of bubonic plague on 6th December, 1939. The child and her mother had left their home to arrive in Calcutta four days previously because plague had broken out in their village and one of their neighbours had died of it. The child developed fever and a bubo a day before admission to hospital.

The success that has attended the use of sulphapyridine in the treatment of several bacterial infections and the difficulty of getting anti-plague serum led us to employ this compound for the treatment of this case from which *Pasteurella pestis* was isolated from material obtained by puncture of the bubo.

The patient was given one tablet (0.5 gm.) sulphapyridine every four hours on the first night. The

following morning, her condition appeared to be worse; she was very toxic and delirious, her temperature was 103°F., pulse 120, respiration 28, and both her lungs were congested. Prognosis was bad and it was decided to push sulphapyridine therapy even to toxic limits. Accordingly one tablet of sulphapyridine was administered orally every four hours, night and day, and in addition 1 gramme of the soluble sodium derivative of sulphapyridine was administered intramuscularly once every day. This was done for three days. The lung condition had progressed through the stages of congestion to consolidation and broncho-pneumonia of both the lungs was present. On the 10th and 11th December, sulphapyridine (soluble) was not available, but the oral administration of tablets was continued as previously. On 12th December, the soluble compound being again available, 1 gramme was administered as before in addition to the tablets. The temperature fell to normal on 13th December and further injection of M.&B. 693 (soluble) was stopped, as the child's condition had improved considerably, but the oral administration of the tablets was continued in the same dosage for two more days, when, on the 15th, it was reduced to one tablet twice daily, and was finally discontinued on the 17th. The temperature had remained normal since the 13th. The bubo which had softened broke down on 10th December, but resolution was very slow and the patient was discharged on the 26th of January 1940. She had therefore received 31.5 gm. of sulphapyridine of which 29.5 gm. had been administered during the first eight days of her stay in hospital. No signs of intolerance were exhibited, in spite of the fact that a maximum dosage of 3 to 4 gm. (6 tablets orally and 1 gm. intramuscularly) had been administered daily for eight days to an ill-nourished child of six years.

*Pasteurella pestis* was isolated from material obtained by puncture of the bubo made just before sulphapyridine therapy had commenced and again 12 hours later, after 1.5 gm. M.&B. 693 had been administered orally. No organisms were isolated from subsequent samples collected after 14 and 20 grammes of the drug had been given. The blood was not examined before the commencement of treatment but no organisms were isolated from the sample collected on the 6th after 3½ gm. had been given orally and 1 gm. intramuscularly, in spite of inoculation into two white rats. The organisms from the bubo were found to be virulent to white rats and guinea-pigs.



Carman (1938) records a lowering in the mortality rate by 50 per cent among six cases of oriental plague treated by him with prontosil soluble where previously his results for 9 similar infections were 100 per cent mortality. This case is therefore published, not as a proof that sulphapyridine is efficacious in the treatment of plague, but as an instance of its value when little else was available for the treatment of that disease.

We are grateful to Col. Mallya, the superintendent of Campbell Medical School and Hospital, for allowing us to publish this case.

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### PSEUDO-PANCREATIC CYST IN A MALARIAL SUBJECT

By M. G. KINI, M.C., M.B., M.Ch. (Orth.), F.R.C.S. (Edin.)  
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THE ætiology of pseudo-pancreatic cyst is generally attributed to an injury of the upper abdomen or a previous attack of acute necrosis of the pancreas causing an effusion in the lesser sac. The effusion may be of various types, it may be clear watery or gelatinous or straw coloured and may contain some extravasated blood. In a few cases it may be coloured green due to the presence of bile. The size of the cyst varies, it may be small or very large, it may be single or bilocular or multi-locular. The diagnosis that the cyst has a pancreatic connection is usually made by the presence of ferments of the pancreas. The presence of the three ferments, especially trypsin, points to its direct connection with the pancreas or that it is a cyst arising from the pancreas. The presence of a starch splitting enzyme alone is not a sufficient proof that it is a pancreatic cyst as this is found in other types of abdominal cysts or even in cases of ascitic fluid. The following case is interesting because there was a big bilocular cyst in the lesser sac, the mid-colic vessels dividing it into two loculi. It was not due to an injury but started with attacks of malaria.

A Hindu male boy, aged 17 years, was admitted on the 6th June, 1938, with a history of acute shooting pain of two months' duration in the left hypochondrium. The pain usually started with the taking of food and continued after food. He noticed a swelling which was firm and was situated more in the left hypochondrium and left side of the epigastrium. On admission he was found to be well nourished, not jaundiced and slightly anæmic, the spleen being palpable two fingers below the costal margin. On examination, the tumour was found in the left hypochondriac region which moved slightly with respiration with no pulsation or dilatation of the veins in front of the tumour. It was globular in shape, dull on percussion and slightly tender. A gap could be felt between the spleen and the tumour and slight thrill on coughing. His urine was found to be normal, motion contained no ova or fat cells, and his urine diastase was found within normal limits. His blood

pressure was 100/60 and his circulatory system was normal. His blood contained gametocytes of malignant tertian malaria. He was treated for malaria and later given aolan injections for the enlargement of the spleen, which reduced its size to a considerable extent. Barium meal radiographic examination showed a bilocular swelling pressing the greater curvature of the stomach and causing two separate dents on it (see figure).



Stomach after barium meal with two dents on the greater curvature due to pressure by the bilocular cyst.

He was operated on on the 16th by a left paramedian incision. A big cyst arising from the lesser sac pressing against the enlarged spleen was found. The mid-colic vessels were found dilated and stretched over the cyst causing loculation. It was difficult to remove the cyst and so it was marsupialized with a Malecot's catheter *in situ* and the abdomen closed in layers. Constant suction drainage was established for three days. Intermittent drainage every three hours was started subsequently still retaining the Malecot's catheter. At the end of eight days, it was removed and the discharge was found to be small in quantity and the sinus healed in about 20 days.

The fluid from the cyst was straw coloured with a sheen on the surface. It was alkaline in reaction containing a trace of chlorides. The deposit showed red cells and leucocytes, but no crystals. Of the enzymes found, amylase was in good quantity, lipase a trace and proteolytic ones nil. Urea content was 47 mg. per 100 c.cm. fluid.

He was discharged but six months later he was re-admitted for pain with enlargement of the spleen. He had attacks of malaria and malarial parasites were found in large numbers in his blood. He was treated for a time for malaria and as the pain did not subside, he was operated upon again. At the second operation it was found that the cyst had entirely disappeared, the spleen was found very much enlarged and there were no adhesions though many were expected as a result of previous operation. The abdomen was closed in layers and the patient was discharged cured.

He was admitted for a third time four months later for pain. His spleen was found enlarged and he gave a history of recurrent attacks of malaria. A barium meal examination was done and it was found that the stomach was normal and showed good emptying though the intestines showed here and there evidence of slight

obstruction. He had regular motions and so it was thought not advisable to open his abdomen, and he was treated for his malaria.

He comes of a hysterical family, his mother is suffering from hysteria. On investigation, his recurrent attacks of colic were found to become severe every time the father asked the boy to return to school. Once his doctor gave him morphia for the attack of pain and since then the attacks became very frequent and the boy demanded morphia to be given. His general condition has improved. He reports in his letter dated 3rd September, 1940, that he is keeping good health except for vomiting of bile once a fortnight. He states his spleen has gone down in size and the report from his doctor shows he is now free from malaria. A change of place has done him good.

#### Points of interest

(1) A bilocular cyst in the region of the pancreas is described associated with enlargement of the spleen and attacks of malaria. After marsupialization the cyst had completely disappeared.

(2) Recurrent attacks of colic were complained of, and each time blood examination showed the presence of malignant tertian malarial parasites. He had an enlarged spleen to start with, which got smaller after treatment by injections of aolan, and subsequent attacks of malaria increased the size of the spleen. Though the cyst was not connected with the spleen, it is difficult to say whether malaria had not something to do with the development of the pseudo-pancreatic cyst and hence it is reported.

(3) The cyst contained a starch-splitting enzyme with a trace of lipase and there was absence of proteolytic enzymes. It cannot be classified as a true pancreatic cyst. Being in the region of the lesser sac, it is classified as a pseudo-pancreatic cyst. Is it possible, due to recurrent attacks of malaria, the perisplenitis caused effusion in the lesser sac? It is well known that in cases of enlarged spleen in malaria the splenic artery undergoes endarteritis with thickening of the wall. The splenic artery supplies branches to the pancreas also. Due to the changes in the blood vessels does the pancreas share in the chronic inflammation and does it reflexly produce an effusion in the lesser sac? So far no cases of this type have been published, neither has the clinical condition of this case shown any evidence of pancreatic disturbance.

(4) Latterly, the boy had become hysterical. The severity of the colics was found to synchronize with the father's asking the boy to go to school. Having once got morphia the boy began to get frequent attacks of colic demanding the same injection. Now he is free from colics and malaria but complains of vomiting of bile once a fortnight. He reports his spleen has gone down in size. He has been asked to return for further investigation.

(5) The bilocular nature of the cyst causing dents upon the greater curvature of the stomach, as shown in the radiographic picture, is due to enlargement of the spleen which prevented the

expansion of the sac towards the left hypochondrium and lumbar region thus exerting pressure on the stomach.

My thanks are due to the Radiologist, Dr. P. Kesavaswamy, for the photograph and to Dr. V. K. Narayana Menon, Professor of Biochemistry, for his report on the biochemical nature of fluid sent to him for examination.

#### TREATMENT OF GONORRHOEA WITH M.&B. 693 : 75 PATIENTS

By C. E. R. NORMAN

Chief Medical Officer

and

D. DAVID

Assistant Surgeon, South Indian Railway Company, Limited, Golden Rock

THE urethral smear was positive in every case before treatment. Treatment consisted of 4 days' oral administration of M.&B. 693, two tablets three times a day, one day's interval and another course of 4 days' treatment. No rashes were observed; a certain number of cases complained of headache and giddiness, a few

Number of cases	Duration	URINE SEDIMENTS AFTER TREATMENT		Unfinished
		Positive	Negative	
10	1 to 5 days	2	8	Nil
11	1 week	2	9	Nil
24	10 to 15 days	2	20	2
18	1 month	2	15	1
8	2 months	1	7	Nil
4	> 2 months	2	1	1
75		11	60	4

vomited occasionally in two cases of which treatment was suspended for a day, and about half a dozen cases showed a sudden rise of temperature at the end of treatment.

#### HYDATID CYST IN THE TRANSVERSE MESOCOLON

By MANMOHAN NATH KHANNA, F.R.C.S. (Eng.), F.R.C.S. (Edin.)

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*History.*—A boy, ten years old, was referred to me for a visible growth in the upper part of the abdomen, weakness, jaundice, dyspepsia and constipation. The swelling was first noticed over four years ago, and later it went on increasing gradually until it attained the present dimensions. He had become much emaciated and had many attacks of jaundice, during which his stools were clay-coloured and the urine was very high coloured, pointing to obstruction of some sort to the free passage of bile.

**Examination.**—Emaciated child with marked jaundice. A lump visible in the upper part of the abdomen in the mid-line, the size of a tennis ball, firm in consistency, moving with respiration, not connected with the liver. Chest barrel-shaped as a result of the upward pressure of the lump. Provisional diagnosis of a retro-peritoneal growth or a hydatid cyst was made, in spite of the absence of any history of his association with dogs. Blood count showed 5 per cent of eosinophils. No other test for hydatid disease could be carried out for want of facilities. Operation was advised and the child was admitted into Ishardas Kapur Hospital, Lahore, on 1st July, 1940.

**Treatment.**—On 2nd July under general anaesthesia the abdomen was opened by a right para-median incision. General survey of the abdomen was rapidly made. Gall-bladder was full, tense and shining, could be emptied by gentle pressure, and no stones could be felt. Liver free and surface smooth; spleen normal, appendix normal, stomach and intestines free. Omentum and transverse colon free, but on lifting the transverse colon up, a large growth was seen and felt in its mesocolon. The growth was found to be about 11 to 12 inches in diameter, extending down to the vertebral column, but there was no pedicle; hence its entire removal was not possible. The swelling was firm but not hard. The great omentum and the transverse colon were lifted upwards and the small intestines pushed downwards. The lower part of the transverse mesocolon was exposed, and a bloodless spot was chosen. Incision was made in the peritoneum and the growth exposed. Trocar and cannula were pushed in and fluid came out under tension, it contained sand-like granules. Diagnosis of hydatid disease was made and the opening was enlarged. The whole of the true cyst was removed by forceps in one piece. This cyst-wall was found to be smooth on the outer side, which was in contact with the adventitious cyst formed from the mesocolon; and was rough and granular on the inner side and contained a number of small cystic projections arising from it. There was no hæmorrhage from the cavity. The cavity was thoroughly cleaned with ether and swabs of gauze, and was then closed. The stump was invaginated and the peritoneum stitched over it. Abdomen was closed.

The fluid which was collected at the time of tapping was examined by the hospital pathologist, who reported the presence of hooklets. Thus the diagnosis of hydatid was confirmed.

The boy regained consciousness after two hours and was given glucose saline per rectum and intravenously. Next morning, distension of the abdomen, which showed signs of increasing, was noticed. He was, at once, put on 1/12th of a grain of morphia every six hours, heat to the abdomen, flatus tube, etc. The condition disappeared on the fourth day. From that day, he began to show signs of improvement, the jaundice began to decrease, the urine became lighter in colour, and bile began to appear in the stools. He made a complete recovery in two weeks.

When discharged from the hospital, he was quite well, with good appetite and no discomfort of any sort, no lump in the abdomen and no jaundice. But the lower part of the chest which had become widened out still remained in that state, and it is presumed it will take a long time to return to normal. The cyst was pressing upon the bile passages causing jaundice, upon the stomach and intestines causing dyspepsia and constipation, and pushing the chest wall out in order to make room for itself.

In conclusion, my sincere thanks are due to Dr. Balbir Singh, the hospital pathologist, for examining the fluid, and finding the hooklets for me, and to the medical superintendent of Ishardas Kapur Hospital, Lahore, for allowing me to report this case.

**Summary.**—A case of hydatid cyst in the transverse mesocolon has been described.

## A CASE OF SNAKE BITE SUCCESSFULLY TREATED WITH THE HELP OF THE 'IRON LUNG'

By R. LINTON

MAJOR, I.M.S.

Superintendent, Mitford Hospital, Dacca  
and

NASIMUDDIN SARKAR

Teacher of Medical Jurisprudence, Dacca Medical School

On the 12th July, 1940, a boy aged about 12 years, was admitted into the Mitford Hospital, Dacca, for the treatment of snake bite.

The history of the case was as follows: The boy was sleeping on the floor of a *katcha* house about four miles away from Dacca town. At about 3-30 a.m. he suddenly cried out that something had bitten him on the right foot. On examining the foot it was found that there were two small punctured wounds with two drops of blood on the inner side of the right foot. A dead frog in a macerated condition was found on the patient's bed. The boy's relatives at once called an *ojha* to treat the case. He continued treatment up to 6 a.m. when the boy became unconscious, and it was decided to bring him to the Mitford Hospital where he arrived at 9-30 a.m.

**Condition on admission.**—The patient was deeply unconscious and his reflexes including the corneal reflex were abolished. The pulse was rapid, regular and fairly full. Respiration was shallow, irregular and infrequent, the rate being six per minute. The patient was deeply cyanosed and there was fine froth at the corners of his mouth and nostrils. There were two small punctured wounds about one inch apart on the instep of the right foot, and the foot and ankle were considerably swollen and œdematous. There was no discharge from the punctures and no ecchymosis. The case was diagnosed as a bite by a poisonous snake of the colubrine group.

**Treatment.**—An injection of 20 c.cm. of antivenene was administered at once by the intravenous route and respiratory and cardiac stimulants were also given. In spite of this the condition of the patient became worse. At this stage the senior author saw the case and suggested that the patient should be put in the 'iron lung' which had recently arrived as a free gift from Lord Nuffield. It was got ready and the patient was put in at 10-15 a.m. By this time the case was regarded as hopeless as his respiration had practically ceased and the pulse was imperceptible at the wrist. The respiration rate was adjusted to 18 per minute and the first effect noticed was the blowing out of a quantity of fine froth which was wiped away by an attendant. At 10-30 a.m. the cyanosis disappeared and at 10-45 the pulse became strong and full. The administration of antivenene was continued in the meantime through the arm hole in the 'lung' and an amount of 110 c.cm. in all was given. At about 11-15 the corneal reflex was restored and the patient responded to questions at 11-30. Thereafter improvement was rapid but the patient was kept in the 'lung' until 3-15 p.m. when he was taken out and given some food. He had a febrile reaction for the next 24 hours after which his convalescence was rapid and uneventful, and he was discharged from hospital on the 20th when the condition of his foot had cleared up.

**Discussion.**—It is not claimed that the 'iron lung' is a miraculous cure for snake bite. In fact it would probably be of no use at all in bites by the viperine group of snakes, or in colubrine cases where a very large dose of venom had been injected. In a case of colubrine snake bite, death is due to respiratory failure

but the artificial respiration produced in it appears to be so efficient that respiration can be kept going normally for a considerable time after the respiratory centre has been completely paralysed. The main difficulty in the treatment of snake bite still remains, *viz*, getting the patient to hospital alive. Nevertheless, this case has demonstrated that if a case of colubrine snake bite can be put into the 'iron lung' while a vestige of life remains he can be kept alive long enough to allow antivenene to take full effect.

## TWO FATAL CASES OF CARDIAC MALARIA

By S. K. SARKAR, M.B., B.S.

Assistant Surgeon, B. N. Railway, Dongargark (C. P.)

CARDIAC malaria in the sense that the brunt of the attack falls on the heart and the patient suddenly develops symptoms of heart failure in the course of an ordinary attack of malaria is, I think, sufficiently interesting, and that is why I would like to report two such cases that I happened to meet with. I have been working in highly malarious areas for the last six years and have encountered various manifestations of malignant tertian infection, but no others with the symptoms that these two cases presented.

*Case 1.*—On 17th October, 1939, a young man, aged about 16, got a typical attack of malarial fever with ague and bilious vomiting. I prescribed atebirin for him (0.1 g. *t.d.s.*). He had no fever the next day, but the fever returned in the early hours of the morning of 19th. He had taken two tablets of atebirin on 18th, but none on the 19th. I saw the patient again at about 5-30 p.m. on the 19th. He was fully conscious, and had an anxious look. He was very restless and complained of pain all over the body, particularly in the region of the præcordium and beneath the sternum. There was no radiation of this præcordial pain. Breathing was very distressed. Extremities were cold, but the body was hot. No radial, brachial or facial pulse could be felt. Heart sounds were distinct and regular, but very fast. The borders of the heart could not be properly percussed out. The bases of the lungs had a few râles. The spleen and liver were palpable. I gave him a cardiazol injection immediately and a few minutes later one intramuscular injection of quinine and adrenaline. He died shortly afterwards.

On enquiry I learnt that this boy had developed these urgent symptoms at about 12 noon, but as he was conscious the father did not consider them to be of any significance.

*Case 2.*—On 12th December, 1939, I saw a woman of about 60 suffering from high fever accompanied with ague. Cinchona and alkaline mixtures were prescribed for her. At about 9 p.m., I was called to see her again. She was conscious, but very restless. Breathing was distressed. Extremities were cold, but the body was warm. No pulse could be felt anywhere. Heart sounds were weak and regular, but fast. No râles were heard at the bases of lungs. Liver and spleen were not palpable. I gave her a cardiazol injection. She died half an hour later. She had developed these urgent symptoms at about 6 p.m.

*Discussion.*—In the *Indian Medical Gazette* for March 1938, Manohar and Khosrawy described anginal pain in a case of malaria. In

that article they have quoted references about cardiac malaria in the literature. In these quoted cases, sections of the heart showed malarial thrombosis and cloudy degeneration of the muscle or cloudy swelling of cardiac muscle resembling that of acute diphtheria, or vascular thrombosis with fragmentation and necrosis of cardiac muscle. As I could not procure the original articles, I could not make out if this malarial thrombosis is due to plugging of cardiac capillaries with malaria parasites similar to what happens in cerebral malaria. Manson-Bahr (1940) mentions death from suddenly developed cardiac failure in pernicious forms of sub-tertian malaria due to the severe toxic fatty degeneration of the myocardium, but does not mention malarial thrombosis in cardiac malaria. Whatever the exact pathology, severe toxic fatty degeneration of the myocardium or malarial thrombosis, this suddenly developed heart failure is rare and a very dangerous complication of malignant tertian malaria.

Both these cases described above showed fairly large numbers of malignant tertian rings in their blood. In both cases no history of any infection that could leave a damaged heart was elicited from relatives. Both developed identical symptoms of heart failure in the course of an ordinary attack of typical malaria and died within a few hours. Both remained conscious up to the last.

My thanks are due to my chief for permission to report these cases.

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## A CASE OF GONOCOCCAL VULVO-VAGINITIS TREATED WITH M.&B. 693

By S. K. SARKAR, M.B., B.S.

Assistant Surgeon, B. N. Railway, Dongargark (C. P.)

THE following case of gonococcal vulvo-vaginitis that responded very well to M.&B. 693 when other reputed drugs like septanilam and clinoestrol failed to have any effect.

*Case note.*—A girl aged about five was found by her parents to have a vaginal discharge on 4th September, 1939. Weak permanganate of potassium baths and lotio mercurochrome application were tried for a few days without any improvement. On 14th September, she was sent to Khargpur railway hospital where the discharge was definitely proved to be gonococcal by smear examination. There she was put on prontosil tablets (one twice a day). Discharge stopped after three days of prontosil therapy; but recurred after 24 hours. She came back from Khargpur with instructions to be treated with clinoestrol. Clinoestrol was started here (0.5 mg. tablets—half twice a day). As there was no improvement at the end of a week dosage was increased to one tablet twice daily. She continued

it for another fourteen days. Towards the end of this period painful engorgement and deepening of pigmentation of her breasts were noticed, but no improvement of the vaginal discharge was seen. Clinoestrol was then stopped, and septanilam (one twice daily) was given for seven days without any improvement. Septanilam was then stopped and M.&B. 693 was started after seven days, on the suggestion of my medical officer. Discharge stopped after the second day of M.&B. administration (one twice daily). It was continued in the same dosage for three days more, then one daily for another five days. Discharge has not recurred up to now, which is over four months.

My thanks are due to my chief for permission to report this case.

## A CASE OF ENTERIC PNEUMATOSIS

By S. T. DAVIES

MAJOR, I.M.S.

*Superintendent, Government Hospital, Calicut*

The following case of enteric pneumatosis (gas-cysts of the intestine) is reported in view of the rarity of this condition, although it gives rise to no symptoms and is said to be of no clinical importance.



The patient was a Hindu male, aged 35 years, with clinical indications for gastro-jejunostomy. As the abdomen was opened hundreds of gas-cysts (*see figure*) were found throughout the whole length of the small intestine except the last three inches; they varied from the size of a small pea to that of a grape, and were mostly sessile but many were pedunculated. Pressure on the sessile ones caused the gas to run under the serous coat of the intestine.

## CEREBRAL MALARIA SIMULATING MENINGITIS

By JAGDISH NARAYAN, M.B., B.S.

*Civil Assistant Surgeon, Chatra Hospital,  
District Hazaribagh*

B. M., a Mohammedan male, aged 24 years, cultivator by occupation, was admitted on 8th March, 1940, for the treatment of (i) high fever and (ii) acute headache; duration—three days.

*History.*—The patient had severe rigor followed by rise of temperature on the 6th March, 1940, at 6 p.m. The temperature showed remission on the 7th morning but again there was a sharp rise in the evening preceded by severe rigor, acute headache and backache.

*Condition on admission.*—General condition—fair; no anemia, no cyanosis. Tongue—dry and coated. Bowels—constipated. Pulse—feeble, 130 per minute, regular. Heart sounds—normal. Lungs—moist sounds at the bases. Temperature—101°F. (axillary).

*Treatment.*—Blood films were taken for the examination of malaria parasites and the patient was put on

quinine sulphate mixture 5i, *t.d.s.*, each dose containing seven grains of quinine sulphate. Blood films showed ring forms of malignant tertian malaria parasites.

9th March. There was rigidity of neck and muttering delirium present with unusual cry at times. No response to external stimuli. Patient lying on back in semi-comatose condition.

*Reflexes.*—Superficial abdominal reflex absent. Knee jerks exaggerated. Kernig's sign positive. Extensor plantar reflex present. Temperature—101.4°F. (maximum).

*Treatment.*—(i) Soap water enema.

(ii) Quinine sulphate mixture 5i thrice daily.

(iii) Quinine bihydrochloride, gr. x in 2 c.cm. saccharose solution intramuscularly.

(iv) Lumbar puncture done at 4 p.m. to relieve pressure symptoms. The fluid was under pressure but clear. Microscopic examination did not reveal anything particular.

10th March. Temperature—100°F. (maximum). Muttering delirium and rigidity of neck present. Had a restless night.

*Treatment.*—(i) Quinine sulphate mixture 5i, *t.d.s.*

(ii) Alkaline glucose draught *ad lib.*

(iii) Quinine bihydrochloride, gr. x in 2 c.cm. in saccharose solution injected intramuscularly.

(iv) Sleeping draught one dose at bed time.

11th March. Temperature—99°F. (maximum). Rigidity of neck and muttering delirium persisted. Bowels constipated.

*Treatment.*—Same as previous day.

12th March. Temperature—98.4°F. (maximum). No more delirium present. Rigidity of neck also less.

*Treatment.*—Quinine sulphate mixture 5i three times a day.

13th March. Temperature—99.6°F. (maximum). Rigidity of neck and muttering delirium absent. The temperature rose after rigor and accompanied with headache and backache.

*Treatment.*—Quinine sulphate mixture 5i, thrice daily, each dose containing five grains of quinine sulphate.

14th March. Temperature—98.4°F. (maximum).

15th and 16th March. Temperature—98°F. (maximum).

*Treatment.*—Same as before.

17th March. Temperature—101°F. (maximum). The temperature rose in evening preceded by rigor, acute headache, and backache.

*Treatment.*—(i) Alkaline glucose draught *ad lib.*

(ii) Atebrin tablets, one *t.d.s.*

18th March. Temperature—101°F. (maximum) preceded by rigor, headache and backache; onset in the evening.

*Treatment.*—Atebrin continued.

19th March. Temperature—98°F. (maximum).

*Treatment.*—Same.

Total 15 atebrin tablets were given followed by plasmoquin treatment.

The patient remained in the hospital up to 28th March. He was afebrile and progressing favourably.

Features of interest in this case are:—

(i) Cerebral malaria simulating meningitis.

(ii) Failure of quinine both by mouth and injection to control the temperature.

(iii) Success of atebrin tablets in controlling the temperature.

No doubt pressure symptoms decreased after quinine injection but temperature was not controlled\*.

\* This fact is not clear from the notes.—Ed., I. M. G.

# Indian Medical Gazette

FEBRUARY

## GOITRE

IN a recent number we published a short paper in which were summarized the results of a questionnaire on goitre issued by an enterprising medical officer in charge of a dispensary in the Kangra district in the Punjab. The analysis of the replies he received seemed to indicate that the condition was widespread, varying considerably in incidence in different districts, but that no new or standardized form of treatment was being adopted. What particularly distressed the writer was that the surgical treatment of this condition was being neglected. What strikes us as being more serious is that the simple preventive and early treatment procedures which are of established efficacy are not being used to the extent that they might be, for, if they were, fewer patients would reach the stage where surgical treatment was indicated.

From time to time we have received communications from other parts of India, usually montane or sub-montane areas, reporting the prevalence, or making enquiries as to the ætiology and treatment, of endemic goitre.

One such enquiry led us to look up the recent literature on the subject especially with reference to goitre in India. In view of the quite considerable literature on the subject, which includes the *Indian Medical Research Memoirs*, No. 23, and the monograph, *The Simple Goitres*, both by Sir Robert McCarrison, it is remarkable how little real information regarding the public health aspects of goitre in India, its ætiology, and the treatment most suited to the prevailing forms of goitre is available. Sir Robert McCarrison claims to have shown that there are at least three common types of goitre and that the ætiology is probably not the same in each case. He has shown that a number of dietetic factors will influence the growth of the thyroid, and that in addition insanitary and unhygienic conditions tend to increase the ill-effects of unsuitable dietary, or even to produce thyroid hypertrophy *per se*. He has also shown the effect of iodine but has made a particular point of emphasizing that iodine is not the only factor in goitre production and cure. This is very probably true for there are certainly anomalies in the distribution of goitre *vis-à-vis* iodine content of soil, but it is also true that of the various combinations of factors that appear to play a part in the production of goitre the most commonly recurring one is iodine deficiency, actual or relative, in the soil and water,

and it would be a pity if, as a result of Sir Robert McCarrison's excellent researches which have had the stimulating effect of destroying complacency on the subject of the ætiology of goitre, we were to allow our attention to be distracted by vague generalities regarding improving environmental conditions and the standard of living from the established fact that iodine given systematically will usually reduce the incidence of endemic goitre.

Hospital and dispensary reports of the different provinces give some idea of the relative incidence of the disease in India. The largest numbers of cases are encountered in the United Provinces, especially in the districts of Gonda, Gorakhpur and Dehra Dun; in this province the average number of cases treated annually is about 100,000. In Bihar the annual hospital and dispensary returns indicate about the same incidence; in this province the largest number of cases come from Champaran districts. Assam (particularly Goalpara district), the Punjab (particularly Kangra district), and Bengal each show about 30,000 cases annually. From Madras, Bombay and other districts negligible figures are reported.

Colonel H. Stott, I.M.S., who made a special study of the disease in the hyperendemic areas, found that goitre was rare below the age of 3 years. Between 3 and 5 years the rate is less than 5 per cent, though the percentage rises higher in severely affected areas. The incidence is 10 to 20 per cent between 6 and 14 years, but the rate may reach 80 per cent in areas of greatest endemicity. Between 15 and 30 years the rate rises to 60 per cent, but falls again above 30 years. He further reported that very few educated and well-to-do persons suffer from this condition, which is definitely more prevalent among females; for every one male roughly three females are affected.

The term 'goitre' is applied in a general way to any visible enlargement of the thyroid gland of a non-inflammatory and a non-malignant nature. The most physiological form of thyroid enlargement is simple goitre which results from the compensatory hyperplasia of the thyroid and is not associated with obvious symptoms of deficiency or excess of secretion. The condition is endemic among adolescents, especially among young girls, who reside in certain localities, including districts where the iodine supply in the drinking water, soil, and vegetables is inadequate for physiological needs; the symptoms are most prominent among this group, because the iodine supply becomes insufficient only when the biochemical changes associated with puberty, menstruation, pregnancy, lactation and emotional strain demand increased thyroid activity. Sporadic cases of simple goitre may develop in iodine-rich districts following infections, intoxications or strain, which reduce the efficiency of the thyroid tissue, which divert from the thyroid gland its normal quota of iodine, or which in other ways necessitate an extra supply of



thyroxin. In general, the areas of high endemicity are found in mountainous country or remote from the sea. Some of these regions are old ice-fields where most of the iodine has been leached from the soil.

Heredity is also a factor, for the incidence in endemic districts is higher among the offspring of goitrous parents and is greatest when several generations of ancestors have been goitrous. The onset, or an exacerbation of signs and symptoms, is frequently observed in association with infective diseases such as tonsillitis and influenza. Animal experiments suggest that other factors may be found in unsuitable diets and in general unhygienic conditions, and the recently discovered thyrotropic hormone in the anterior lobe of the pituitary, which on injection into animals produces hypertrophy of the thyroid gland, may be an important clue to the causation of the disease. All these forms of experimental goitre can, however, be prevented by a sufficient supply of iodine.

There has also been evidence suggesting that goitre occurs in people who drink water contaminated with something which does not pass through a porcelain filter, and which is destroyed by boiling the water; these observations suggest, but do not prove, that one of the exciting causes is microbic. Experimentally it has been shown that an enlargement of the thyroid gland follows the ingestion of the residue on a filter through which goitrogenous water has passed. It is possible that the bacteria may absorb the iodine before it can be taken up by the thyroid, and in this way produce simple goitre, rather than by their direct toxic action on the gland. The greater the contamination of the water, the greater is the amount of the iodine necessary to prevent the disease.

Thus, it appears that a combination of factors is responsible for incidence of the disease. But it will be noticed that, though investigations have led us into devious paths, these paths lead us back to one point, namely, shortage, absolute or relative, of iodine. Endemic goitre may therefore be regarded as a deficiency disease; this has received confirmation in the successful prophylactic use of iodine in various endemic areas.

Two methods of iodine administration are practised: (a) The admixture of a small percentage of iodine with table salt, sodium or potassium iodide being added in the proportion of about 1 in 200,000; as a public health measure in some countries where endemic goitre is common, all table salt offered for sale has to contain this amount of iodine; and (b) the administration of iodine to school children, the dosage being about 3 grains of potassium iodide daily for ten days twice a year, in spring and autumn. Higher doses are in excess of requirements and wasteful. Iodine should also be given in a similar dosage to women during pregnancy and lactation. The latter method has proved successful in America.

The results of such prophylaxis have been shown to be so excellent that endemic goitre may now be ranked as one of the few diseases that medical science has really mastered. One of these methods should certainly be adopted in all the endemic districts of this country where some such measure is not already in operation, and in controlled labour forces, such as those of tea gardens, this should present no difficulties.

The treatment of established simple goitre is less satisfactory than the prophylaxis; prevention is once again better than cure. Administration of iodine should be given a trial; it may prove successful, but diminution in the size of the gland is by no means the rule. Then the question of the danger of provoking hyperthyroid symptoms by the ingestion of excessive quantities of iodine arises, and, though it has never been definitely shown that this occurs, it is advisable to be cautious in the treatment of simple goitre particularly in subjects with a nodular gland, and patients should be discouraged from taking it on their own initiative without reference to their medical advisers. When iodine fails to effect improvement, thyroid should be given, *under strict medical supervision*. This will usually lead to the disappearance of any symptoms of hypothyroidism, but as far as the diminution in the size of the gland is concerned the results are uncertain. Surgical treatment should only be considered—if symptoms of thyrotoxicosis develop, if the gland is nodular, if malignant changes are suspected, if pressure symptoms arise, or if the swelling is disfiguring.

Graves' disease presents a more complex problem, both in its ætiology and in its treatment. In this condition the thyroid secretes thyroxin far in excess of the needs of the organism. There is no known ætiological relation between this condition and endemic goitre, and in fact in areas of endemic goitre it is no more common than in the ordinary population. It is not due to iodine deficiency, although iodine administration brings at least some temporary improvement. The precise cause of this condition is yet unknown. There is a good deal of controversy on the point. Some workers consider that the disease originates in the thyroid gland, and the local therapeutic measures adopted by the surgeons and roentgenologists are in keeping with this view. Others consider the thyroid involvement to be part of a general constitutional disorder associated with widespread dysfunction of the autonomic nervous system. It is also possible that the essential disturbance is an excess of the thyrotropic hormone of the anterior pituitary gland.

Mental trauma such as domestic or financial worry, anxiety, or shock, not infrequently with a sexual association, are often suggested as exciting causes. However, the thyrotoxic subject is a restless, nervous and 'highly strung' individual, and one does not know how far this condition is the cause of, or the result of, the Graves' disease. The great war did not appear



to cause any increase in Graves' disease; it will be almost conclusive proof that mental trauma plays little part in its ætiology if there is no increase in England under present conditions.

The treatment of Graves' disease involves the institution of a broad regime of therapy involving hygienic, dietetic, medicinal, psychotherapeutic and/or surgical measures. Most cases require full study and careful assessment before the line of treatment can be decided upon. For instance, mild thyrotoxic symptoms in a young girl will often disappear on solution of some family or emotional problem, whereas a middle-aged woman with a nodular gland is referred for operation as soon as possible. In other cases, the patient on account of a high metabolic rate will require absolute rest, both physical and mental, for a few months, with sedatives such as phenobarbitone, and probably iodine as well. The effect of iodine is not curative, but it holds the symptoms and basal metabolic rate in check, and causes the disease to run its course at a lower level of activity. It is given as Lugol's solution in 10 minims doses (equivalent to 1 grain iodine) or preferably as potassium iodide in  $1\frac{1}{2}$  grain doses three times a day. Incidentally, there is much to be said for the substitution of potassium iodide for Lugol's solution. The full effect is usually obtained in ten to fourteen days. Subsequent progress will depend on whether or not the remission has set

in. If it has started, a steady improvement may continue; but, if the disease is still progressing, iodine should be continued for weeks or months in smaller doses (half or even less). The prolonged administration of iodine is however not approved by the surgeon. If operation is contemplated, it should be carried out as the remission sets in. The difficulty arises in pre-operative management of cases who have been given iodine for prolonged periods. Most surgeons prefer freshly-iodized subjects and will not operate unless an iodine-free period of 6 to 8 weeks has elapsed immediately before the pre-operative iodine treatment.

Radiotherapy has been practised for many years; there is much controversy as to its usefulness, but recent claims have been made that it can replace surgical treatment in 75 per cent of cases, and it is undoubtedly less risky. However, if a case does not show considerable improvement within 3 months, radiotherapy is not likely to be successful.

Thyroid extract is obviously contraindicated in such cases. We publish elsewhere in this issue the report of a case of primary Graves' disease in which thyroid in increasing doses had been prescribed, with very unfavourable results. 'To administer thyroid substance to the patient with Graves' disease is tantamount to pouring gasoline on a conflagration'.

## Special Articles

### HÆMATOLOGICAL TECHNIQUE

#### PART VIII

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and

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#### (13) *The Arneth and Schilling counts*

ARNETH (1904) divided the neutrophil polymorphonuclears into five main classes according to the number of segments in the nuclei which in their turn were classified into various groups according to the shape of the lobes. Under the original classification the count was very complicated and had only limited application in general practice. Cooke and Ponder (1927) modified and simplified the Arneth count taking into account only the five original basic divisions of the Arneth count without going into the intricate subdivisions of Arneth.

Schilling devised a method in which the differential leucocyte count and a simple nuclear lobe count of the neutrophils were incorporated and considered in the form of a 'hæmogram'.

*Apparatus required* (vide part VI).

*Smears.*—Smears for the Arneth and Schilling counts should be very thin and uniformly

spread; they should be dried quickly by waving them to and fro under a fan (*vide* part VI).

*Staining.*—Combined staining with May-Grünwald and Giemsa stains gives the most satisfactory result—the nuclei stain deeply, the connecting chromatin filaments are well shown, while the granules also show characteristic colour and size. If May-Grünwald and Giemsa stains are not available, proper staining with Wright's or Leishman's stains, though not as satisfactory, gives quite good results. Iron-hæmatoxylin or hæmatoxylin staining for these counts in preference to any of the Romanowski stains is sometimes advocated; while these stains bring out the nuclei and the chromatin filaments well, the colour of the granules is not distinctive so that differentiation between neutrophils and eosinophils is very difficult.

#### A. *Arneth count*

The nucleus of the neutrophil polymorphonuclear cells is divided into lobes which may be separate or joined together by fine filaments of chromatin. Cooke's criterion of separate lobulation is that either the lobes should be distinctly separate, or should be joined together by a fine chromatin filament, but not by broad bands of nuclear material. Lobulation of the nucleus, it

is assumed, gives an indication of the age of the cell—the less the lobulation the younger is the cell. The youngest cell in the normal peripheral circulation is one which has a nucleus shaped like the letter C, while the cells with five or more distinct nuclei are the oldest. The principle of the method is to make a differential count of the neutrophil cells, to group the cells according to the lobulation of the nuclei, and to calculate the percentage of cells in each group.

The cells of the various types can be described as follows:—

Class I. Neutrophil granulocytes in which the nucleus has only one definite lobe, or two or more lobes joined by a definite band of chromatin and not by thin filaments.

Class II. When there are two separate lobes joined by one thin filament, or when there are two completely separate lobes.

Class III. When there are three separate lobes connected by two thin filaments, or there are three completely separate lobes.

Class IV. When there are four separate lobes connected by three thin filaments, or there are four completely separate lobes.

Class V. When there are five or more separate lobes connected by four or more filaments, or there are five or more completely separate lobes.

The count is made by identifying and classifying one hundred neutrophil granulocytes from different parts of the slide, and the result is usually reported in the following form:—

*Example 1, a normal count*

Class	..	I	II	III	IV	V	Total
Number	..	10	25	47	16	2	100

When there is an increase in the number of cells with one and two separate nuclear lobes, i.e., of class I or class II, at the expense of those with three or more lobes, there is said to be a 'left shift' in the Arneth count, as in the example given below:—

*Example 2, a 'left shift' count*

Class	..	I	II	III	IV	V	Total
Number	..	41	44	14	1	0	100

Conversely, when there is an increase in the 4- and multi-lobed nuclei, it is known as a 'right shift'.

*Example 3, a 'right shift' count*

Class	..	I	II	III	IV	V	Total
Number	..	9	22	36	23	10	100

Various indices and methods of expressing more concisely the results of the Arneth count (Cooke's modification) have been proposed. Probably the most suitable of these methods is the calculation of the weighted mean of the nuclear lobes; this is obtained by multiplying the number of cells in class I by 1, the number in class II by 2, the number in class III by 3, the number in class IV by 4, the number in

class V by 5, and then adding together and dividing the sum total by the number of cells counted.

The weighted means of the nuclear lobes in these three examples are calculated in the following way:—

Example 1	Example 2	Example 3
$1 \times 10 = 10$	$\times 41 = 41$	$\times 9 = 9$
$2 \times 25 = 50$	$\times 44 = 88$	$\times 22 = 44$
$3 \times 47 = 141$	$\times 14 = 42$	$\times 36 = 108$
$4 \times 16 = 64$	$\times 1 = 4$	$\times 23 = 92$
$5 \times 2 = 10$	$\times 0 = 0$	$\times 10 = 50$
100 275	100 175	100 304
Weighted mean = 2.75	1.75	3.04

*Interpretation.*—Immature granulocytes and cells of Arneth class I and some of class II, but none of class III, IV or V, are found in the bone marrow. If there be a sudden stimulus to the bone marrow to produce granulocytes, as in an infection, the leucocytosis is brought about by young cells appearing in the blood, the number and the proportion of these depending upon the nature of the stimulus and the reacting power of the marrow of the individual, and there is a shift to the left in the Arneth count. But leucocytosis as a result of muscular exercise is only due to redistribution of cells, is not accompanied by any increase of young leucocytes in the peripheral circulation, and is therefore not associated with any 'left shift'.

Again, in chronic infection or toxæmia, there is an increased leucocyte destruction, which may or may not be balanced by new leucocyte formation; in the former case there will be leucocytosis or a normal count and in the latter leucopenia. In either case there is an increase in young forms, actual or relative, which results in a shift to the left and a decrease in the weighted mean. It will be apparent that this shift is quite independent of the total leucocyte or total granulocyte count, and provides another 'angle' on the degree of the toxæmia.

In pernicious anæmia and certain other conditions of bone marrow dysfunction, there is a shift to the right in the Arneth count, and therefore an increase in the weighted mean; in such conditions there are many multi-lobulated

*Normals*

	I	II	III	IV	V	Weighted mean
Cooke and Ponder (1927)	10	25	47	16	2	2.75
Kennedy (1933) (Iraq)	13	30	43	10	4	2.62
Das Gupta (Calcutta)	40	43	15	2	0	1.79

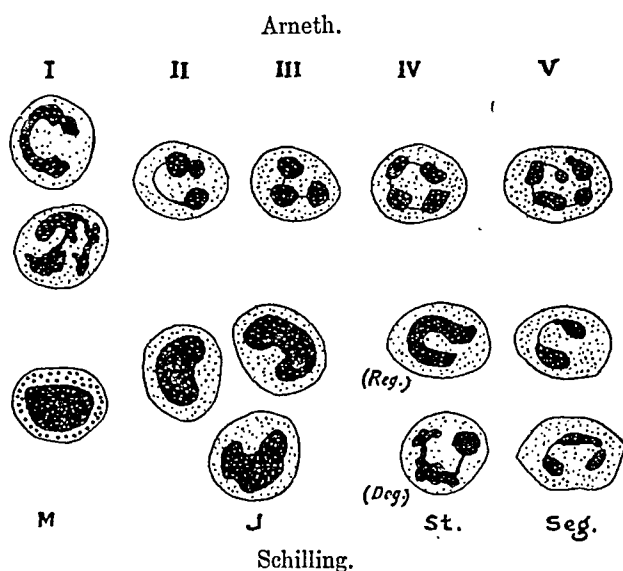
cells and only very few young cells coming into the circulation.

*B. Schilling count*

In this count the neutrophil granulocytes are divided into four groups and classified as follows :—

1. Myelocytes (M).
2. Juveniles (J); these have a distinct indentation in the nucleus; they correspond to our meta-myelocytes.
3. Stab cells (St); these have a C- or horse-shoe-shaped nucleus but no true lobulation; they correspond to class I of the Arneth count, and to our staff cells.

Stab cells may be of the regenerative or degenerative type, and are differentiated by the shape and staining reaction of the nucleus; in the latter the nucleus is ribbon-like and pycnotic with clumps of chromatin, and usually irregular shaped, and the cytoplasm may be vacuolated.



4. Segmented (S) polymorphonuclears, showing two or more distinct lobes.

According to Schilling the following are the constituents of a normal hæmogram.

Total	Percentages							
W. B. C.	B.	E.	M.	J.	St	Seg.	L.	Mon.
5,000 to 8,000	0-1	1-2	0	0-1	3-5	57-67	21-35	4-8
	..	..	60-70				..	..

B. = basophil. E. = eosinophil.

L. = lymphocyte. Mon. = large mononuclears.

*Discussion.*—The Schilling hæmogram is much more than a differential granulocyte count, as is the Arneth count, and Schilling claims that it gives far more information. The interpretation depends on a highly imaginative series of responses to infection and toxæmia that are supposed to, and possibly do, occur in the hæmopoietic system in which there are three

phases, neutrophilic struggle, monocytic defence, and lymphocytic cure, but it does not seem to take into account the nature of the infection and the consequent variations in the response. Further, there are so many directions in which changes may take place, that the hæmogram seems peculiarly susceptible to facile interpretation to suit the conscious or unconscious wishes of the interpreter.

We do not propose to give a full discussion on the interpretation of the hæmogram, as it has only an indirect bearing on the subject of anæmia, but, as far as the neutrophil granulocyte elements are concerned, Schilling's contention is that infection may cause two types of reaction, the regenerative reaction and degenerative reaction; in the regenerative reaction, new leucocytes are formed in the bone marrow and this is reflected in the peripheral circulation by a rise in the total white-cell count, an increase in the juveniles and regenerative forms of stab cells, while in the degenerative reaction, which is found in severe toxæmia, on account of the degenerative influence of the toxin on the marrow, the formation of new cells is retarded; this may be shown by a leucopenia. In the differential count of such a case there are few juvenile cells, and the stab cells that reach the circulation fail to segment at the usual rate, and may degenerate with the result that there is a preponderance of stab forms, including many degenerative forms, in the blood. The reaction, however, may not be purely regenerative or degenerative in character, but may be a mixture of the two, and the hæmogram may be intermediate, with slight leucopenia and a greater preponderance of the younger cells than in a purely degenerative process.

(It is surprising to the writers that no provision is made in the classical Schilling hæmogram for the separate counting of the regenerative and degenerative forms of stab cell, when obviously the presence or absence of the latter is an important factor in the interpretation of the hæmogram.)

*Conclusion.*—The interpretation of the Arneth count is simpler, though the implications are more limited, but it presents a minor practical objection in that more skilful staining is required to ensure accurate counting of the separate lobes.

The value of these counts is mainly in establishing the presence of infective or toxæmic factors, which may be important contributory causes of the anæmia, and/or may prevent response to appropriate hæmatinics. The presence of multi-lobular cells, shown only in the Arneth count, is important in the diagnosis of pernicious anæmia.

*(14) The erythrocyte sedimentation rate*

The determination of the erythrocyte sedimentation rate (ESR) is not a test that gives much direct information regarding the nature of the anæmia, but it is of value in differentiating

'functional' disorders, such as pernicious anæmia in which the true ESR is within normal limits, from anæmia due to such causes as sepsis and malignant disease in which the ESR is markedly increased.

Further, the ESR is affected by changes in the shape and size of the red cells, in so far as these changes affect rouleaux formation, and by changes in the concentration of the red cells in the plasma; this last may overshadow the other changes and, being a measurable factor, must be allowed for in estimating the true sedimentation rate.

Finally, as from the single specimen taken in the normal course of a routine blood examination the ESR can be estimated without additional labour, it should always be included.

The test suffers from the multiplicity of the methods by which it is performed and by the variety of the forms in which the results are expressed. The most commonly used technique is that of Westergren (1926), but, as it is important that the correction for anæmia should be made and as no correction chart has been worked out for this technique, this method has its limitation.

Wintrobe's method (1933) is really a modification of this method; it has the advantage that the cell volume can be estimated on the same sample of blood and also that a correction for anæmia can be made.

**Principle of the test.**—A known volume of blood is intimately mixed with a definite amount of anti-coagulant, and the mixture is drawn into a tube of known calibre up to a certain point; the tube is then allowed to stand in an upright position at room temperature and the level of the red blood cells in the tube is noted at the end of one hour and again after two hours. The fall in the level of the red cells is expressed in millimetres.

#### *Westergren's method*

##### *Apparatus required—*

##### *I. Sedimentation tubes.*

Westergren tube. This is about 300 mm. long and is graduated from 0 to 200 mm. in 1 mm. intervals; it has a uniform bore of about 3 mm. and is open at both ends.

##### *II. Special Westergren rack, or an improvised rack, to keep the tubes in a vertical position, and to prevent the blood escaping.*

##### *III. Anti-coagulant:—3.8 per cent sodium citrate solution.*

##### *IV. Syringe, etc., for collection of blood.*

##### *V. Stop watch.*

**Technique.**—In this method 3.8 per cent solution of sodium citrate is used as anti-coagulant in the proportion of one part of citrate solution to four parts of the blood.

Put exactly 2 c.cm. of blood into a flask to which 0.5 c.cm. of 3.8 per cent solution of sodium citrate has already been placed. Mix immediately by rotating the flask and subsequently if possible in a shaker; then draw up the mixture into a Westergren's standard tube to the zero mark which is exactly 200 mm. from the tip.

The tube is now set upright in a stand in which a spring clip holds the points of the tube firmly against a rubber cork at the bottom end. The tube is now left to stand and the upper level of the red cell column, which is generally sharp, is read at the end of one and again after two hours\*. The length of the column of plasma from the zero mark to the top of the red cell column is the amount of sedimentation and this is read off in millimetres; this is reported as the sedimentation rate in millimetres for one hour and for two hours.

##### *Normal limits (after one hour)—*

	Men	Women
Textbooks ..	3 to 5 mm.	4 to 7 mm.
Our own experience in	3 to 15 mm.	5 to 40 mm.
Indians in Calcutta.		

The high figures that we obtained in apparently normal subjects are partly explained by the higher temperatures that prevailed, compared with those of the places where the tests on which other normal figures are based were carried out.

#### *Wintrobe's method*

##### *Apparatus required—*

##### *I. Wintrobe's tubes—a flat-bottomed glass tube 100 mm. long graduated from 0 to 100 in 1 mm. intervals; it has a uniform bore.*

##### *II. Anti-coagulant—sodium and potassium oxalate mixture (vide part I).*

##### *III. Electric centrifuge.*

Together with a syringe and stop watch as in Westergren's method.

**Technique.**—Wintrobe used his cell-volume tube for the determination of the sedimentation rate.

The blood is collected in an 'oxalated' flask and is thoroughly mixed; the cell-volume tube is filled with the oxalated blood by means of a capillary pipette up to the zero mark, which is exactly 100 mm. from the bottom. The tube is now allowed to stand upright in a vertical position on a special stand or on a tray of plasticine, and the reading is taken at the end of one and again after two hours\*, in the same way as in Westergren's method; the cell-volume tube is then put into a centrifuge and centrifuged at 3,000 revolutions per minute for half an hour to obtain the packed cell volume percentage; thus both procedures are done in the same tube with the same blood sample.

##### *Normal limits (after one hour)—*

	Men	Women
Textbooks ..	0 to 9 mm.	0 to 20 mm.
Our own experience in	2 to 20 mm.	2 to 30 mm.
Indians in Calcutta.		

**Correction for anæmia.**—One important factor in the rate of sedimentation of bodies in fluid is the concentration of these bodies. The sedimentation standards for red cells in plasma are based on there being a normal number of red cells in a given volume of blood, and in anæmia when these are reduced the sedimentation rate is increased above the normal irrespective of the other changes in the blood. To make the correct allowance for this fact Hynes and Whitby

\* Only one-hour readings are usually recorded.

(1938) worked out a chart showing the relationship of cell volume and sedimentation rate in normal blood and in blood showing various degrees of anæmia; this chart is reproduced below.

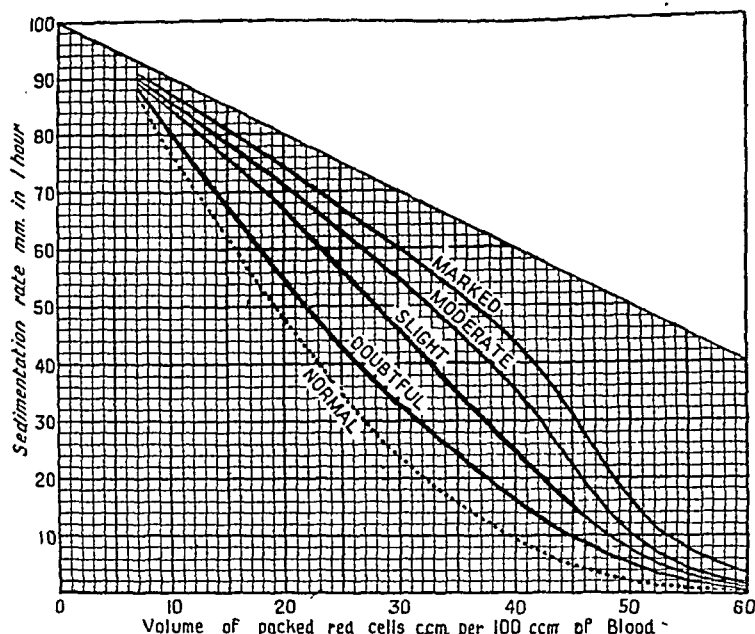


Chart for correction of sedimentation rate for anæmia by means of the corpuscular volume.

To correct for anæmia, find the junction of the lines of the observed sedimentation rate and the observed corpuscular volume; this point will fall in one of the five zones (normal, doubtful, etc.) which indicate the approximate degree of increase in the rate. If a 'compensated' figure is required, follow the appropriate curve down to the point where it cuts the 45 c.cm. vertical lines, for men, and the 40 c.cm. line for women.

Example: Observed rate = 50 mm.; observed corpuscular volume = 30 per cent; point of junction lies in area of 'slight' increase; compensated rate for men = 18 and for women = 28.

#### Precautions

- (i) All apparatus must be scrupulously clean and dry.
- (ii) The dilution with sodium citrate solution in Westergren's method should be absolutely correct.
- (iii) The specimen of blood should be collected during the fasting state and examined within one hour of collection.
- (iv) In women it is advisable to avoid the menstrual period and the few days before and after it.
- (v) The specimen should be rejected if there be a slight trace of coagulation or any marked hæmolytic.
- (vi) The tubes should be set up in an absolutely vertical position in a quiet place, well away from any apparatus that vibrates. The temperature of the room should be between 72° and 80°F. whenever possible.
- (vii) In recording the results, correction for anæmia must always be applied.

**Discussion.**—There are a number of factors involved in the phenomenon of erythrocyte sedimentation, but the most important is the size of the rouleaux formation and this is mainly determined by the composition of the plasma.

Increase in plasma fibrinogen will cause an increase in the size of the rouleaux formation and therefore an increase in the sedimentation rate. It is probably on this fact that the value of this test depends, as, with the exception of the concentration of the red cells for which allowance can be made, this effect overshadows all others.

The sedimentation rate is increased in so many conditions that it is very dangerous to attach any specific diagnostic significance to it. This must be quite obvious from the wide range of the ESR rates that has been recorded in apparently healthy individuals. However, the ESR is a test of great value in estimating the progress in chronic infections, such as tuberculosis and leprosy. A standard technique should be adopted, and in reporting the results the method employed must be stated or the information loses much of its value.

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#### ON THE CHOICE OF DRUGS IN THE TREATMENT OF BACTERIAL INFECTIONS

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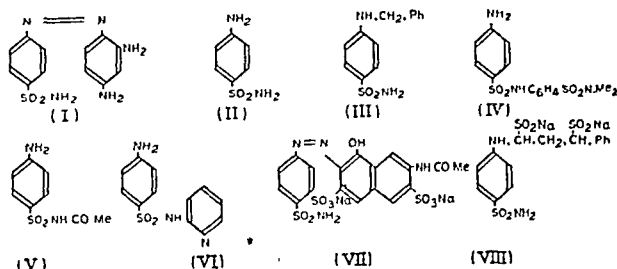
(From the Bengal Immunity Research Laboratory, Baranagore, Calcutta)

THE extensive investigations carried out during the last 5 years with experimental animals, as well as in the clinical fields, have afforded to the physicians a number of organic sulphur-containing substances for combating the various bacterial infections. The value of this chemotherapeutic treatment with sulphanilamide, or its derivatives, is now beyond question. Physicians, however, should be fully cognizant of the fact that these compounds

possess not only extraordinary therapeutic activity but at the same time exert a wide range of toxic manifestations, some of which are mild and may be safely ignored, while there are others that are of serious type and if not heeded in time may even endanger the life of their patients. Obviously, it would always be a sound practice to find out the causative agents of the disease before instituting this drug therapy. The well-known method of treatment by the long established immunotherapy should also not be totally ignored, particularly when the clinical diagnosis and special considerations regarding any individual patient warrant it.

### Chemical nature

A scientific discussion, therefore, on the rational use of the various drugs that are now available in the market seems likely to be of interest. The most common products are 4'-sulphonamido-2, 4-diamino-benzene (Domagk's compound I), sulphanilamide (II), benzyl, sulphanilamide (III), sulphanilyl-dimethyl sulphanilamide (IV), sulphanilacetamide (V), 2-sulphanilamido pyridine (VI)—all for oral use, and Neoprontosil (VII) and  $\gamma$ -phenyl-propyl-amino phenyl sulphonamide  $\alpha$ :  $\gamma$ -disodium sulphonate (VIII) for parenteral administration.



From the above structural formulæ it would be evident that all are derivatives of the compound (II)—p-amino-benzene sulphonamide—the most widely used drug of the series. It is active against hæmolytic streptococci of groups A, B and C, and meningococci, less so against gonococci, and possesses no specific action against the pneumococcus, with the exception of type III. By substituting the p-amino grouping by one or other radicle or any chain, either its solubility as in (VII) and (VIII) may be increased or the toxicity as in (III) may be lowered. On the contrary, when the hydrogen atom of the sulphonamido group is substituted by any other group, its range of activity is considerably widened as evident from the compounds (V) and (VI) which were also found to be efficacious against pneumo- and gonococcal infections.

### General consideration

The question arises what type of compounds is to be selected for a particular treatment and again how the course is to be planned. At the very outset, it may be pointed out that the type

of infecting micro-organism, as well as the severity and place of infection, is of primary importance. Other clinical considerations, such as age, secondary infections or physiological disorders, are also not to be brushed aside. Infants and children generally tolerate the drug more easily than the aged. The infections of soft tissues are better controlled than those of the bones. The patient receiving this drug treatment should be seen daily by his physician, and, if this be not practically possible, then the instruction should be laid down to record the body temperature once in the early morning and once in the evening, and to watch for any nausea or vomiting. This might help in the detection of the side reactions associated with the drug therapy. Further, it is preferable that the hæmoglobin and the total white blood cell count of the patient should be ascertained at least twice a week. The ideal method would be to study the concentration of the drug in the blood and other body fluids. A concentration of 5 mg. of the drug per 100 c.cm. of the blood is sufficient to kill the invading organisms in milder infection, whereas a 10 to 15 mg. concentration might be necessary in severe infections of hæmolytic streptococcus, meningococcus, gonococcus or pneumococcus. Long, Bliss and Feinstein (1939) have drawn up charts indicating the dosages that might be required for persons of different ages and that again with different types of infections. There are so many factors in this new drug therapy that it is very difficult to chalk out a correct dosage for each and every type of patient. The time required for absorption of the drug, the liver's function to convert the drug to a comparatively less effective product by acetylation of the para-amino grouping, and the rapidity of excretion are the factors that hinder any generalization on the mode of dosing. The four-hour dosage schedule is very important for the fact that the maximum concentration of the drug in the blood has invariably been found to be reached within this period. The individuals who are found not to absorb the drug to the proper concentration, should be treated with higher doses. But as soon as the patient is feeling better and when his temperature has subsided, the dose may be gradually reduced from say 12 tablets to 6 and then to 3 tablets (6 gm. to 1.5 gm.). But it should be very judiciously continued till the patient is completely cured as continuous administration of the drug may give rise to toxic symptoms and even agranulocytosis.

If again the patient be suffering from renal disorders, every measure should be taken for the effective elimination of the drug within a reasonable limit (i.e., within 48 to 72 hours). This is of special significance from the fact that non-excretion of the drug may increase blood concentration and thereby produce the characteristic side reactions. Excess of fluids might help in urinary output and the consequent excretion of the drug, but too much liquid by inducing rapid



solubility would facilitate easier and earlier absorption of the drug in the blood and thereby might again promote toxic manifestation. In adults, 6 pints in all will be found to be adequate and it should be decreased according to age. On the basis of the observations of Snodgrass and Anderson (1937) it has been the general custom to place a restriction on the diet. No excessive dietary restrictions (even eggs or onions not excepting) is necessary, unless the nature of infections or the condition of the patient demands it (Banks, 1939). Of course no saline purgative should be given; oils, liquid paraffin, or an enema may be administered for the movement of the bowels. Regarding the toxic manifestations it may be said that these mostly occur on a basis of sensitivity or idiosyncrasy. Most of the side reactions of pure sulphanilamide therapy are of milder nature and can be safely avoided (Basu, 1940). It creates an acidosis by increasing the excretion of sodium and potassium in the urine and for this every dose of the drug should be given with sodium bicarbonate (total daily dose being 3 to 3.5 gm.). The other common toxic manifestation is the production of a type of cyanosis owing to the formation of methæmoglobin (Wendel *et al.*, 1939) and it may be removed even when found to be severe, by injecting a one per cent solution of methylene blue (0.1 to 0.2 c.c. per kg. of body-weight) (Wendel, 1939).

#### *Pharmacological and physiological characteristics*

*Sulphanilamide*.—The biochemistry of sulphanilamide has been more thoroughly studied. It is found to be evenly distributed throughout the body (Marshall *et al.*, 1937). This simpler compound is being successfully used in streptococcal tonsillitis, pharyngitis, acute otitis media, and mastoiditis with lesser dosage. With a more heroic dosage the drug is effecting wonders in erysipelas, cellulitis, puerperal fever, and streptococcal and meningococcal meningitis. For the prevention of clinical acidosis, it should always be administered with sodium bicarbonate. Ingestion of glucose also favours its tolerance.

It is the duty of the physician to decide whether any surgical treatment is essential in a condition of erysipelas or cellulitis for the removal of any focus of infection, or for letting out pus. The drug should always be given in the puerperium even as a preventive measure, or at least with the first sign of infection. In meningitis the patient should be treated with a very heavy dose and his blood and spinal fluid concentration should be determined. Further, spinal fluid cell counts would be valuable aids in ascertaining the progress of the infection and thereby helping in regulating the doses of the sulphanilamide. In cases where such a study is not possible, the general clinical response of the patient would be a good guide to the physician. Sulphanilamide is also a good urinary antiseptic;

but in any treatment of the urinary tract infections balance between the intake of the drug by mouth and its output in the urine must always be maintained. Precautions for any renal disorders must be observed and a knowledge of the amount of the blood non-protein nitrogen will be a guide in this direction. Under normal conditions, 10 tablets (5 gm. in all) with almost two-thirds the amount of sodium bicarbonate is the corrected daily dose. Though this simpler and cheaper product is effective against so many infections, it is not so efficacious in gonococcal and pneumococcal infections. For the former the compounds (IV) and (V) are being largely used, and in the latter case sulphapyridine (VI) gives better result.

*Sulphanilacetamide* (V).—Sufficient clinical evidence is on record that tends to show that the compound sulphanilyl sulphonamide (Grütz, 1937; Felke, 1938; Shelley, 1939; O'Crowley *et al.*, 1939) is potent against gonococcal infections. But it is less soluble and consequently less rapidly absorbed from the gastro-intestinal tract. Its clinical use is, again, restricted on account of the fact that it often gives rise to peripheral neuritis (Freusberg, 1938; van Valkenburg and von dem Borne, 1938; Bannick *et al.*, 1938). On the contrary, the compound p-amino-benzene sulphonyl acetamide (V) is found to be less toxic and easily tolerated (Dohrn and Diedrich, 1938; Vonkennel and Korth, 1938). In our observations, even total oral doses of 100 tablets (50 gm.) in about 2 weeks did not produce any untoward symptoms. It is absorbed from the intestine and is excreted in the urine within 72 hours. It is always found to be a better drug in the treatment of gonorrhœa.

*Sulphapyridine* (VI).—In pneumococcal infections this compound should be the drug of choice. It does not produce acidosis and is less likely to produce methæmoglobin. It is, however, irregularly absorbed and slowly excreted (Hobson and MacQuaide, 1938; MacLeod, 1939). When again the excretion is impaired owing to any renal damage or for any other cause, the drug is more acetylated in the system and this latter derivative being poorly soluble is precipitated in the urinary tract with resultant urinary obstruction and subsequent development of pyelonephritis. Smith *et al.* (1940) further observe that the crystallization of the acetyl sulphapyridine in the urine may even help in the development of renal calculi. The drug is found to produce a more severe mental and physical depression (Finland *et al.*, 1939). It should not therefore be given to patients with jaundice, or liver or kidney disease. Another side effect of the drug is the production of intense nausea with vomiting (Anderson and Datta, 1939; Bensley, 1940). Sulphanilamide also causes nausea and vomiting, but these are seldom found to be severe. In view of all these observations, particularly for the occurrence of renal damage, the treatment with this drug must be regarded as potentially dangerous and must be avoided



in treatment of patients suffering from diseases other than pneumococcal pneumonia. In this latter dreaded disease the compound is really a very potent drug. But in a tropical country, such as India, pure pneumococcal infections are comparatively rare. Still a detailed study of the bacteriology of the pneumonic or bronchopneumonic condition, and the typing of the infecting bacteria, seems to be of considerable interest. This is of special significance for the fact that if the infection be due to type III, it is quite amenable to the treatment with simple sulphanilamide when again followed up with serotherapy (*vide infra*).

There are two other drugs, sulphonamido-2:4 diaminobenzene (Prontosil Rubrum, I) and benzyl sulphanilamide (III). The former is now of only historical interest and in the opinion of Whitby (1938) the preparation is almost obsolete. The other compound is less toxic than sulphanilamide, but at the same time less efficacious too. On account of its safety, it may be prescribed in milder streptococcal infections. In severe and urgent cases sulphanilamide (II) is the drug of choice.

The two sodium salt derivatives (VII) and (VIII) are of interest for their enhanced solubility. When an immediate effect is necessary, when it is difficult for the patient to swallow the tablet products, when nausea and vomiting are pronounced, or when the conditions do not allow a proper concentration of the drug in the blood, they may be parenterally used. In cerebrospinal infections the red variety (VII), however, penetrates from the blood to the theca more slowly than sulphanilamide (Jauerneck and Gueffroy, 1937). Further, in urinary infections the excreted product is only a urinary antiseptic, in so far as the compound has been reduced to colourless sulphanilamide. In these respects, however, the other compound is invariably being found to be clinically more effective in streptococcal and meningococcal infections. It has also been reported to be efficacious in influenzal meningitis (Teggart, 1938). It is more rapidly eliminated in the urine and always well tolerated, whether injected subcutaneously, intramuscularly, or intravenously, in comparison with the red solution. In meningococcal infection, repeated administration at short intervals is important. The activity of the product is undoubtedly due to the rapid liberation of sulphanilamide in the circulation.

#### *Synergy treatment*

The treatment of bacterial infections by means of the various synthetic drugs has now become so widespread that physicians often become unaware of the fact that various problems still remain unsolved in connection with the proper development of chemotherapy. The experiments so far carried out with laboratory animals or with human beings clearly show that these drugs are mainly bacteriostatic, i.e., they

mainly inhibit the multiplications of the micro-organisms in the body. It is the usual natural body defences that really kill the bacteria. Consequently, the more powerful these defences are the more rapid and complete would be the destruction of the micro-organisms. This suggests a synergy treatment, i.e., a combination of immuno- and chemotherapy. The researches of Fleming (1938), De and Basu (1938), and Loewenthal (1939) with experimental animals revealed the utility of such combined treatment. Cokkinis and McElligott (1938) from their clinical observations in gonococcal infections are of opinion that the treatment with the drug be either delayed for a time to allow the body immunity to develop as a result of the infection, or else the immunity be artificially induced by vaccine therapy. In cases of pneumococcal infections there are various difficulties in following up with the serotherapy (*J. A. M. A.*, 1940) and there is no statistical record still in evidence showing the efficacy of a combined treatment of serum and sulphapyridine (the anti-pneumococcal drug) (Finland *et al.*, 1939). Fleming (1939), however, suggests that in such infections a combination of polyvalent vaccines and sulphapyridine would afford a better result (Maclean *et al.*, 1939). That the synergy treatment with specific serum and sulphanilamide is a more useful and effective means of combating pneumococcus type III pneumonia has again been advanced by Finland and Brown (1939).

#### *Conclusion*

Considering the various aspects of this new therapy in combating bacterial diseases it seems that in streptococcal, meningococcal and urinary infections the less toxic and cheaper product sulphanilamide should be the usual drug of choice. But for various trade names it is often difficult for a physician to trace the true nature of a product. It may be said here that Prontosil Album (Bayer), Sulphanilamide-p (British Drug House and Burroughs Wellcome), Bisulphonamide (Bengal Immunity), Streptocide (Evans), Septanilam (Glaxo), and Bactesid (Continental Drug) are all products containing pure p-amino-benzene sulphonamide (sulphanilamide). In gonococcal infections sulphanilacetamide is a better tolerated drug. Albucid (Schering) as well as Bianicide (Bengal Immunity) contains this compound. Sulphapyridine is the only potent drug until now discovered against true pneumococcal pneumonia. M.&B. 693 (May and Baker) is the proprietary product containing this chemical. There is also Sulphapyridine (Merck Co., U. S. A.). If the infection be of type III, it may be more safely treated by sulphanilamide combined with sera or vaccine. This synergy treatment is also found to be more beneficial in gonococcal infections. Whenever a parenteral mode of administration is found necessary, the phenyl-propyl-amino sulphanilamide disodium sulphonate (VIII) might be

more freely used. Soluseptasine (May and Baker), or Bisulphonamide injection (Bengal Immunity) contains this product. In pneumococcal infections the sodium salt of sulphapyridine is again available for injection. Whatever product is used, it must be from a stock properly prepared, stored and standardized. In the case of tablets, the question of time of disintegration, and, in the case of solution, its storage away from the light are of special importance (De and Basu, 1937).

When one drug is found ineffective, the other may be used, or, when one mode of treatment fails, the other method should be followed. It must be remembered that the conjugation by acetylation in the system renders the drug ineffective. The degree of conjugation varies with individuals and this is why the precise therapeutic effectiveness cannot be always predicted. The effectiveness of any drug in human medication depends upon the systemic condition of the particular patient in question. Finally, it is to be noted that any therapy has its limitations, as well as its dangers. A correct and proper method of treatment, therefore, demands constant observation by a careful physician.

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## ERYTHEMA STANDARD FOR DOSE IN LIGHT THERAPY

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THE administration of medicine to the patient is the easiest part of the system of biochemical medicine. Measurements are the necessary foundation of any science or art. Measurement which is very easy in the case of drugs is a very complicated process in case of radiations. This circumstance is due largely to the usually inconstant nature of the source of light and to the marked variation in response that different individuals and their tissues show to irradiation. The response is different in the aged and the young, in the fair and in the dark, in males and females, in people living outdoor and indoor lives, in different seasons, and a difference is even noticed in the various regions of the same person.

The solar radiations are not yet fully understood. What we know is only an infinitesimal part of the solar spectrum. Even in this small portion we have not been able to separate each individual radiation. We know groups of rays, but not the individual rays which compose the group. Similarly with regard to the rays which spread over the vast range of the electromagnetic spectrum and which number millions and whose wave-length ranges from .0004 Å to many kilometres. Therefore when we speak of the ultra-violet rays or x-rays, we do not

particularize single separate rays with the same clear-cut precision, as when we speak of hydrogen we refer to the individual element having the invariable atomic weight of 1. But we refer to groups of rays which come within a particular range of wave-lengths. Now within this range, there are hundreds of different rays with varying wave-lengths. For aught we know their actions may also be varying. We group them relying on rough similarities in their effects.

Such are the indefinite materials with which the radio-therapist has to work. Even these, such as they are, are materially affected by reflection, refraction, and atmospheric absorption during transmission. The radiations pursue a straight course in ether, but as soon as they come into contact with the earth's atmosphere their course is affected by its material contents. Where the atmosphere is thickly laden with dust particles, as over big cities, the short wave-length radiations are almost entirely absorbed. This is with regard to the sun's radiations. The quality of radiations produced by artificial methods varies according to the source of production and also at different times from the same source; the distance is also an important factor to be considered, as the intensity of radiation varies inversely with the square of the distance. Moreover, the organ of the body through which the radiations pass behaves in different manner in different individuals. The skin of one man may allow a certain amount of radiations to pass. The skin of another man may not allow the same quantity to pass. So this will require the dose to be varied in each case. The skin performs various functions, the chief of them being protective, sensory, heat-regulating, respiratory, secretory, and excretory. To the radio-therapist the heat-regulating and protective functions of the skin are of great importance in determining the dose. Skin is a rough rampart protecting the body from all harmful contacts—chemical or physical. It is in fact an expansion of the nervous system. Skin has a network of sensory nerve terminals which are sensitive to the slightest touch or irritation. If the attacking irritant is mild the skin remains unaffected, but if it is a strong one, which is likely to be harmful to the body, there follows a battle royal in our tissues at the site of entrance of the irritant. The blood vessels in the affected spot dilate causing an increase in the blood flow. A condition of hyperæmia follows which is commonly seen in the early stages of inflammation. It begins with redness and develops further stages according to the strength and intensity of the irritant. The exuded leucocytes and serum offer opposition to the intruder. After the enemy is destroyed the inflammation subsides gradually. Where the irritant is a radiation, then too the same result follows. This reaction of the skin to radiations is technically called erythema.

### *The effect of the sun's rays on the skin*

Erythema is a local redness of the skin which develops in 1 to 8 hours depending on the sensitivity of the subject and intensity of radiations. It is a true inflammatory reaction as a result of the stimulus of radiant energy. It is a just hyperæmic stage of inflammation.

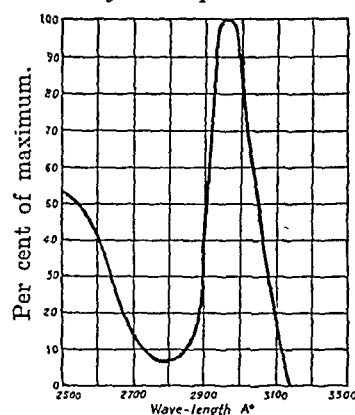
Infra-red rays, light rays and ultra-violet rays are the three kinds of radiations which are used in light therapy. The skin is sensitive to them but in different ways. Infra-red rays form the largest part of sun's radiations. Their proportion is more than 50 per cent. In artificial sources of light too, their proportion is always more than  $\frac{2}{3}$ . The skin is therefore accustomed to heavy doses of infra-red rays. As the effects of infra-red on the skin are immediate and easily detectable by the sensation of heat, the dose in the case of infra-red can be easily determined by the limit of tolerance of the patient. As there are no bad after-effects, there is no harm in taking the dose to the extreme limit. The same may be said about visible light rays. The eyes can easily detect excess of light. There is also a thermal effect and the tolerance level of the skin and the eye is a safe guide for determining its dose. Ultra-violet rays are different from those two in their effects. The body is not accustomed to heavy doses of ultra-violet rays; their percentage in sunlight is only 4. They cause no immediate effects on the body; their effects are seen a few hours after exposure. They produce toxic effects on skin, eyes, etc. Their action is chemical and multifarious. As at the time of exposure, there is absolutely no sensation of any kind, there is every possibility of giving an excessive dose with disastrous effects. A cautious physician might give a small and ineffective dose while an enthusiastic one might cause harm by an excessive dose. We have seen that skin sensibility varies with each individual. It has been known to vary from 1 to 75 times and sometimes even up to 400 times.

The actions of ultra-violet are erythema, pigmentation, vitamin-D activation, bactericidal effect, and effects on blood and metabolism. Erythema and pigmentation are the only effects that can be detected easily by the eye. Pigmentation occurs after a few days, erythema appears after a few hours. Pigmentation requires a bigger dose than erythema. Erythema is produced by the range from 2,400 to 3,200 which is the biologically active range, and so therapeutically most useful range, while pigmentation is produced by a small part of this range from 2,800 to 3,000. Erythema effectiveness is therefore best suited as a test of skin sensitivity.

Erythema response is not produced equally by all wave-lengths between 2,400 and 3,200. The curve rises to its maximum at 2,967 angstroms, descends to minimum at 2,800

angstroms, then rises again to a smaller maximum near 2,500 (*vide* chart 1).

CHART 1  
Erythema production.



radiation which can be safely and beneficially administered to the subject. Probably the primary function of the pigment is to arrest the excess of sunlight which has a harmful effect. By absorbing most of the ultra-violet rays which penetrate the horny layer, the pigment protects the blood vessels and the living tissues in the deeper layer of the epidermis from the harmful effects of the sun's rays. This is why we have coloured races in the tropics. White men who expose themselves to the sun of the tropics become bronzed and thus immunize themselves from sun-burn. Dwellers in the arctic snows are pigmented for protection against glare. Pigment protects the underlying structures from an excess of light. It absorbs the visible and ultra-violet radiations and by converting them into heat activates the sweat glands. The sweat in its turn cools by evaporation. The pigment is therefore an indefatigable watchman but indiscriminating. It will not discriminate between beneficial and harmful radiations; it closes the door to all. The dose therefore of the radiations must be so regulated as to be unobstructed by pigment. If deep pigmentation occurs the treatment might become ineffective. The tendency to pigment also varies in different individuals. This will necessitate variations in the dose. The skin sensibility test is therefore of great importance and will remain so till we have devised better and more effective means for fixing the dose. In the present state of our knowledge about radiations, radio-dosimetry must rely on the skin-sensibility test.

#### Dosimetry

We would have been absolutely at sea in ultra-violet dosimetry if erythema had not come to our aid. When erythema appears on the skin it means that the limit is reached up to which the radiation may be admitted, thus far and no further. Before beginning the treatment the first thing to be determined is the level to which the skin is accustomed and

the level at which it shows resistance or inflammatory reaction in the shape of erythema. The former shows the level above which the dose begins to be effective and the latter gives the level at which it begins to be harmful. So the physician has to operate between these two levels. Erythema thus furnishes a chart, however crude, in an otherwise uncharted sea. By reference to erythema it becomes possible to obtain some numerical precision in ultra-violet therapy. As long as we have no better method of determining the ultra-violet dose, the erythema test is indispensable.

Its usefulness has been recognized since 1906. In Germany, France, England and America many devices were made to carry out the skin-sensibility test. The technique of all these devices was to expose different patches of skin through holes to ultra-violet rays for varying lengths of time. They had many disadvantages. One person had to attend throughout the test to keep the time, and cover and move the holes. The number of holes was insufficient and as they were all of circular shape it became difficult to distinguish them. In 1927 Dr. Saidman invented an automatic instrument which obviated all the disadvantages of the older methods. It has a clock-work device which requires no attention. It is a small instrument. It has 18 orifices of different shapes. When it is set working, an obturator plate begins to move on the holes and covers one hole per minute so that it takes 18 minutes to cover 18 holes. Each succeeding hole remains open for one minute more than its predecessor. The instrument is tied on the body of the patient and is taken off after an exposure of 18 minutes. In the solarium we use Saidman's automatic skin sensitometric test. This sensitometer is firmly applied to the bare skin to be tested, the part, at the predetermined distance at which the subsequent treatment is to be given, is irradiated by the sun or lamp for 18 minutes, and the skin reactions, erythema and pigmentation are noted—

1. Immediately.
2. After a few hours.
3. After a few days.
4. After a month.

The erythema reactions are divided into four degrees—

Erythema of 1st degree	SE <sub>1</sub> .
" " 2nd "	SE <sub>2</sub> .
" " 3rd "	SE <sub>3</sub> .
" " 4th "	SE <sub>4</sub> .

The pigment reactions are divided into three stages—SP<sub>1</sub>, SP<sub>2</sub>, SP<sub>3</sub>.

First appearance, progress, and evolution of the pigmentation are noted. They are not as useful as erythema in determining the initial dose, as pigment takes a few days to appear, but they are helpful in deciding the increase of subsequent dosage.

*The various stages of inflammation*

	Naked-eye changes	Microscopic
Erythema of 1st stage.	Light redness. Disappears on pressure.	Epidermic reaction. Dilatation of capillaries and slowing of circulation and increased amounts of blood.
Erythema of 2nd stage.	Light redness. Frank erythema. Granular desquamation. Marked pigmentation follows.	Dermo-epidermic reaction. Stasis of circulation and beginning of exudation of serum and blood cells.
Erythema of 3rd stage.	Intense redness surrounded by bright red areola and slight oedema. Desquamation of large plaques of skin. Pigment marked most in the 2nd week.	Marked exudation of serum and blood cells between layers of skin.
Erythema of 4th stage.	Blister formation surrounded by diffuse redness. Very intense red blister.	Excessive exudation and cleavage between various layers of skin. Necrosis of skin cells.

The fourth stage of erythema is out of the question for general use, except in a very localized area and when required for its caustic action on tissue cells or the destruction of localized infection.

The third stage of erythema also cannot be used for a large area of skin. This exfoliative dose can be made use of only in certain localized infection. The body is afraid of such a concentrated dose of radiation and on recovery from the local inflammatory reaction which will take about a week, it puts on a protecting layer of pigment; thus this area becomes pigmented by the end of 2nd week. This dose is also not desirable for general or constant use.

The 2nd stage of erythema is a stimulative reaction. There is marked stimulation of skin cells causing proliferation and increased activity. Chronic inflammatory condition of the skin may be stimulated to healthier reaction. The blood under the skin is stimulated leading to activation of the leucocytes and vitamin D is produced. The only difficulty is that pigment cells are also stimulated and form a prominent pigment layer in a week's time which obstructs the passage of the radiation subsequently. Moreover, there is some desquamation of skin cells. If the desquamation occurs over the whole body, the skin is not in a fit condition for radiation treatment.

In the first stage of erythema dilatation of the vessels, which is an effect seen in counter-irritation by thermal agents or any kind of mild irritant, physical or chemical, occurs. This comes immediately and disappears with equal rapidity, unless the next stage, stasis, is reached in the vessels. This stage may be caused by infra-red radiations (heat rays), in which case it appears immediately, or it may be caused by ultra-violet rays, in which case it appears after a few hours, in other than a few exceptional conditions. Skin circulation is stimulated, and there is mild stimulation of skin cells, not sufficient to cause proliferation; hence no new pigment layer is formed. So it is possible to make use of this dose daily even for the whole body. No after-effect is left on the skin. There is mild stimulation of skin and its function. Stimulation of the circulation underneath the skin has a soothing effect on the nerve terminals. This dose is desirable when the generalized function of the skin is to be stimulated, or a secondary effect on the general circulation or nervous system is desired.

When general irradiation over the whole body is to be given, the skin test is usually taken on the back. But when local treatment is to be given the skin on the part to be treated is tested or on any other part which has a similar thickness of skin. The skin is not the same thickness all over the body; over the papillae on the forehead it varies between 0.06 and 0.09 mm., on the cheek between 0.06 and 0.01, and on the neck, arm, abdomen, back and leg between 0.04 and 0.15. Between the papillae it is thicker. The number of papillae that cover the entire surface of the body are estimated to be 150,000,000. The dermis in most parts of the body is between 1.7 and 2.4 mm. thick.

The thickness of the skin is also a cause of variability in its sensitivity. As thickness varies in different places in the body, the skin sensitivity also varies in the same body. So not only is there a difference in skin sensitivity of different individuals, but in the same individual it varies from part to part according to variations in thickness. For local treatment therefore the skin of the part to be treated is tested or of another part with similar thickness.

Within 18 minutes the graph of the patient's skin sensibility has been drawn to become visible after a few hours. It is a harmless biological experiment on the patient himself. Eighteen minutes is quite a sufficient time to show the erythema level in 60 per cent of individuals. In 40 per cent the exposure time has to be doubled or even trebled. The graduation of the exposure through 18 equal divisions makes it possible to attain a very high degree of accuracy. Thus Dr. Saidman's invention may be said to have laid the foundation of rational dosage in ultra-violet therapy. It has solved the difficult problem in a very simple and accurate manner. No doctor who gives ultra-violet treatment should be without it. It is

simple and in no way costlier than the routine instruments of diagnosis used in clinical medicine.

The skin-sensitivity test neither requires any special study nor involves any heavy expense, and, therefore, there is then no excuse for any physician giving ultra-violet treatment for not making the skin test an essential preliminary to treatment.

While the development of measuring devices and methods and accumulation of knowledge pertaining to biological effects of radiation are progressing the skin-sensitivity test, *i.e.*, the production of erythema, has been adopted as a basis of appraisal. Even when adequate knowledge and measurements become available, the erythema basis may remain as the most practical and important guide.

### *Dosage*

Now a few words about the application of erythema value of the skin test in the determination of the initial and subsequent progressive doses of treatment. From the 18 patches on the skin by means of the sensitometer, we must find out the first patch where the skin begins to show a slight tinge of redness. This is the point where the tolerance level is being exceeded. The patch where the redness becomes pronounced is the point where the exposure begins to have harmful effect. The first patch is called  $SE_1$  and the second  $SE_2$ . The dose has to be manipulated between these two landmarks.  $SE_1$  is just above the level to which the body is accustomed. If any therapeutic effect is to be obtained something more than this level must be given. Just as in the case of the habitual opium-eater a larger dose than he is used to is required to bring about the desired result. The safer course is, however, not to begin with  $SE_1$  at once, but a little below it. The treatment is a graduated course and we have to go on accustoming the skin to larger doses. The very reason which makes the skin variously sensitive to ultra-violet makes it possible by gradual increases to raise its tolerance level by 2 to 5 times. The property of the skin to get accustomed to stronger radiations by use has made ray therapy so extensively useful. Both  $SE_1$  and  $SE_2$  can be pushed higher and larger doses can be administered. As ultra-violet rays are present in the majority of light sources and in the solar radiation, it is necessary to take the erythema test before giving any light therapy.

The course of treatment in ray therapy must set forth the dose to begin with, its gradual increase, the intervals at which it is to be given, and the length of time for which the treatment should be continued. Ordinarily the beginning for general irradiation should be made with a dose which is  $1/3$  or  $1/4$  of  $SE_1$ ; this dose should be gradually increased to reach  $SE_1$  after five or six exposures. This increment will be about  $1/6$  of  $SE_1$  per exposure.

The dose for regional treatment should be one and a half times or twice as much as for general treatment.

The dose for local treatment may be carried to any extent up to  $SE_3$  or  $SE_4$  according to requirements.

Feeble doses should be given to infants with rickets or tetany, to premature babies and to adults suffering from peritoneal or pulmonary tuberculosis, hyperthyroidism, hypersensitive dermatitis, trophic lesions, or thermic instability. The initial dose in such cases should be  $1/6$  to  $1/8$  of  $SE_1$  which should be taken to  $1/2$  of  $SE_1$  in about eight or ten sittings.

General treatment may be given once a day. Regional treatment may be given daily, but, as it is stronger, it would be advisable to give it on alternate days. Intense local doses should not be given more than once a week. In the treatment of sensitive patients or sensitive parts such as the larynx or urethra, the interval should be made longer. If as a result of the exposure the patient complains of fatigue or headache, or shows a rise of temperature, nervous excitement, or increased sensitiveness in the part irradiated, the interval must be increased.

In general and regional treatment, the average number of exposures required are twenty to thirty. In cases where prolonged treatment is to be given, it often happens that the patient ceases to show further improvement after two or three months. This is probably due to the skin, as well as the body, becoming accustomed to the radiation. This is seen less in regional treatment than in general treatment, as all the parts are irradiated daily in general treatment, while in regional treatment each region gets its turn of irradiation after a long interval. When this happens, treatment should be stopped for a month after which it may be resumed.

In emergency cases where urgent treatment is to be given, and there is no time to take the test and, generally, where there are no means to take the test, the following general facts may be kept in mind. Sensitiveness of the skin is higher in the following conditions :—

1. When the skin is thin, fair, and light-haired.
2. When there is absence of skin pigment, as in albinos.
3. The presence of certain diseases, such as hyperthyroidism, diabetes, syphilis, malaria, and phthisis.
4. Presence of certain drugs or substances in the system, *e.g.*, fluorescent dyes such as trypanflavine, eosine and methylene blue, heavy metals, such as gold, silver, bismuth and arsenic, and certain drugs, *e.g.*, iodine and thyroïdin.

Sensitiveness of the skin is diminished in the following conditions :—

1. When the skin is thick, dark and thickly haired.
2. When there is excess of pigment in the skin.
3. Presence of certain diseases, such as hypothyroidism, rheumatic conditions, dystrophia adiposogenitalis, etc.

The average dose for general irradiation with ultra-violet is about 1 to 3 minutes and with total sunlight about 5 minutes. The dose for regional irradiation may be 2 to 3 times the dose for general irradiation. These doses should be reduced in cases where there is reason to suspect hypersensitiveness.

The skin test is taken to determine the dose in each case so that the prescription must be written in terms of the erythematous value obtained by means of the test. Erythema of the particular degree is the time taken to produce that degree of erythema in the individual test.  $1/2 SE_1$  would mean half that time and  $2 SE_1$  would mean double that time,  $3 SE_1$  would mean thrice that time and so on. In the case of ultra-violet and total sunlight, the dose must be prescribed in  $SE_1$  terms as shown above. In the case of pure infra-red the prescription may be written in minutes. The prescription

should state the initial dose, the maximum dose, the rate of increase, and interval between exposures.

The skin tests by the skin sensitometers provide an interesting statistical study. Besides being a guide for ultra-violet treatment when taken in the mass, they furnish data for various classifications from different points of the human skin and its behaviour. They might lead to the finding of properties of different kinds of skins. They may furnish clues to general principles of skin sensitivity. Dr. Saidman has published a record of skin tests which he took in the solarium in France. They necessarily relate to skins of European people. During the last five years of the working of our solarium, we have kept detailed records of 3,477 skin tests, a summary of which is published herewith. It is, I believe, the first record of skin tests in the tropics.

TABLE I

Showing mean of  $SE_2$  and  $SE_3$  and number of patients at different values of  $SE_1$ , for tests taken with STR (solarium total radiation) (vide chart AI)

Value of $SE_1$	$SE_1$		$SE_2$			$SE_3$		
	Number of patients	Percentage	Number of patients	Percentage	Mean	Number of patients	Percentage	Mean
1 min.	75	7.5	74	98.7	9.0	25	33.5	15.9
2 "	53	5.4	44	85.3	9.2	33	62.3	14.4
3 "	27	2.8	23	92.6	11.6	2	7.6	17.6
4 "	38	3.9	36	81.6	12.0	12	32.3	17.1
5 "	33	3.5	23	79.5	13.3	..	..	18.0
6 "	30	3.1	20	66.6	13.7	4	13.3	17.5
7 "	31	3.2	10	32.2	16.2	1	3.09	17.8
8 "	20	2.01	8	40.0	15.7	4	20.0	17.6
9 "	16	1.6	6	37.5	16.7	1	6.25	17.8
10 "	21	2.01	4	19.0	17.1	1	4.7	17.9
11 "	53	5.4	..	..	18.0	..	..	18.0
12 "	29	2.9	7	24.1	17.2	3	10.4	17.4
13 "	57	5.8	..	..	18.0	..	..	18.0
14 "	41	4.2	..	..	18.0	..	..	18.0
15 "	16	1.6	..	..	18.0	..	..	18.0
16 "	3	0.03	..	..	18.0	..	..	18.0
17 "	4	0.04	..	..	18.0	..	..	18.0
Over 18 "	438	44.5	..	..	18.0	..	..	18.0
TOTAL ..	985	..	255	..	..	86	..	..

The solar total radiation as obtained in the solarium cabin is  $2 \frac{1}{3}$  times concentrated.



TABLE II

Shows successive seuils of erythema at different ages obtained in tests taken with solar total radiation (vide chart AII)

Age in years	SE <sub>1</sub>			SE <sub>2</sub>			SE <sub>3</sub>		
	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil
1-5 ..	31	16.1	3.22	2	17.1	3.42	..	18.0	3.60
6-10 ..	57	12.0	2.40	14	14.1	2.82	3	17.5	3.50
11-20 ..	219	12.2	2.44	63	15.1	3.02	21	17.5	3.50
21-30 ..	214	11.4	2.28	64	16.2	3.24	23	17.6	3.52
31-40 ..	193	11.1	2.22	63	15.5	3.10	20	17.4	3.48
41 and over	221	13.4	2.68	44	16.5	3.30	19	17.4	3.48
TOTAL ..	935	12.7	2.54	250	15.7	3.14	86	17.6	3.52

TABLE III

Shows seuils of erythema in male and female children and adults (vide chart AIII)

	SE <sub>1</sub>			SE <sub>2</sub>			SE <sub>3</sub>		
	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil
Male children ..	46	15.8	3.16	4	17.0	3.40	1	17.9	3.58
Female children ..	42	12.1	2.42	12	14.1	2.82	2	17.6	3.52
Male adults ..	535	11.9	2.38	147	15.8	3.16	43	17.6	3.52
Female adults ..	362	12.1	2.42	87	15.8	3.16	40	17.3	3.46

Chart AI.  
STR test.  
Relative mean of SE<sub>2</sub> and SE<sub>3</sub> at different values for SE<sub>1</sub>.

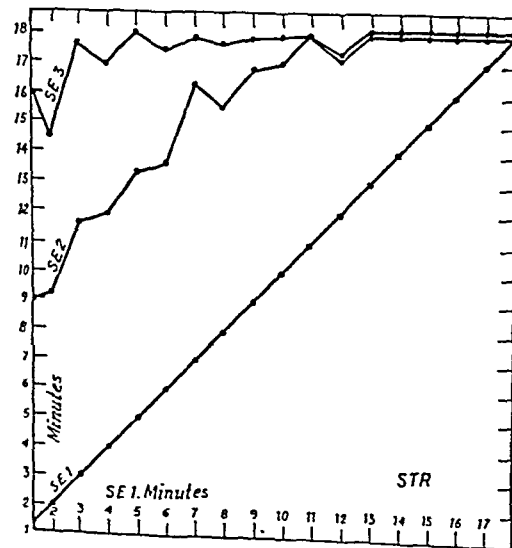


Chart AII.  
STR test.  
Mean of SE<sub>1</sub>, SE<sub>2</sub> and SE<sub>3</sub> at different ages.

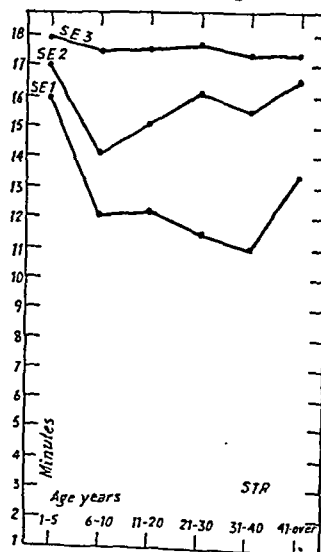


Chart AIII.  
STR test.  
Relative mean for SE<sub>1</sub> in males and females at different ages.

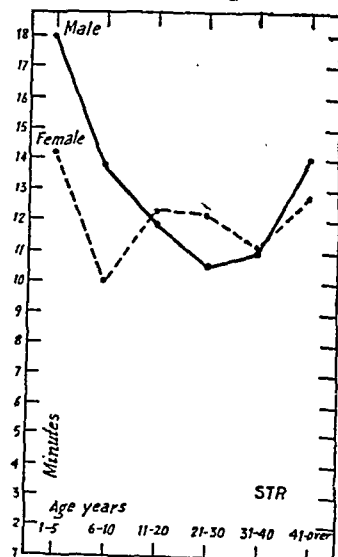


TABLE IV

Showing the mean of  $SE_1$  and  $SE_2$  and number of patients at different values of  $SE_1$ , for test taken with polymetallic arc lamp (vide chart BI)

Value of $SE_1$	$SE_1$		$SE_2$			$SE_3$		
	Number of patients	Percentage	Number of patients	Percentage	Mean	Number of patients	Percentage	Mean
1 min.	266	16.30	248	93.2	11.1	22	8.3	17.7
2 "	19	1.20	16	83.2	9.7	4	21.0	16.5
3 "	180	11.04	153	85.0	14.4	4	2.2	17.8
4 "	35	2.02	29	88.0	12.3	2	6.06	17.6
5 "	115	7.06	65	56.5	14.8	..	..	18.0
6 "	21	1.30	10	47.6	14.0	..	..	18.0
7 "	90	5.50	15	16.7	17.1	..	..	18.0
8 "	12	0.70	8	66.6	14.7	..	..	18.0
9 "	35	2.10	4	11.5	17.4	..	..	18.0
10 "	14	0.90	6	42.9	16.4	..	..	18.0
11 "	110	6.80	2	1.8	17.9	..	..	18.0
12 "	20	1.20	1	5.0	17.8	..	..	18.0
13 "	91	5.60	1	1.1	17.0	..	..	18.0
14 "	26	1.60	..	..	18.0	..	..	18.0
15 "	15	0.90	..	..	18.0	..	..	18.0
16 "	3	0.20	..	..	18.0	..	..	18.0
17 "	1	0.06	..	..	18.0	..	..	18.0
Over 18 "	579	35.50	..	..	18.0	..	..	18.0
TOTAL ..	1,632	..	558	..	..	32	..	..

Data:—1. Distance .. .. 18 inches.

2. Current .. .. Direct  
Voltage 60  
Amperes 12

3. Kind of electrodes .. Polymetallic Heliocure carbons.

4. Size .. .. Positive 9 × 250.  
Negative 10 × 250.

TABLE V

Shows successive seuils of erythema at different ages obtained in tests taken with polymetallic arc lamp (vide chart BII)

Age in years	$SE_1$			$SE_2$			$SE_3$		
	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil
1-5 ..	72	16.5	3.30	5	17.4	3.48	..	18.0	3.60
6-10 ..	175	14.2	2.84	15	16.7	3.24	1	17.9	3.58
11-20 ..	436	10.0	2.00	137	15.8	3.16	9	17.9	3.58
21-30 ..	436	7.7	1.54	195	15.7	3.14	9	17.5	3.50
31-40 ..	212	9.0	1.80	90	14.5	2.90	7	17.6	3.52
41 and over	299	10.4	2.08	116	15.5	3.10	6	17.9	3.58
TOTAL ..	1,630	11.3	2.26	558	15.9	3.18	32	17.8	3.56

TABLE VI  
Shows seuil of erythema in male and female children and adults (vide chart BIII)

	SE <sub>1</sub>			SE <sub>2</sub>			SE <sub>3</sub>		
	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil
Male children ..	152	15.4	3.08	11	17.5	3.50	..	18.0	3.60
Female children ..	95	15.2	3.04	9	17.0	3.40	1	17.9	3.58
Male adults ..	899	9.4	1.88	354	15.2	3.04	19	17.6	3.52
Female adults ..	484	9.0	1.80	184	15.4	3.08	12	17.8	3.56

Chart BI.  
Arc lamp test.  
Relative mean of SE<sub>2</sub> and SE<sub>3</sub> at different values for SE<sub>1</sub>.

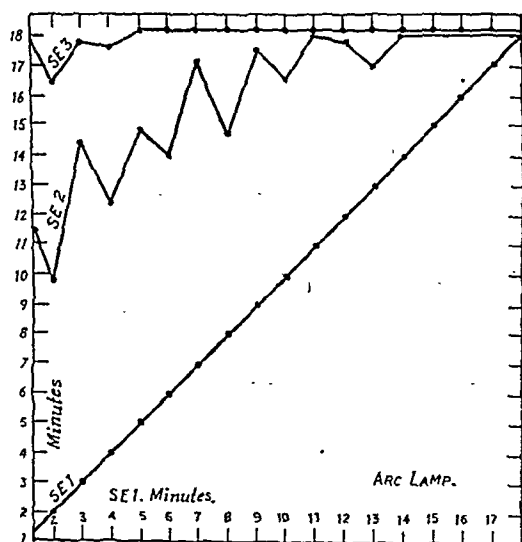


Chart BII.  
Arc lamp test.  
Mean of SE<sub>1</sub>, SE<sub>2</sub> and SE<sub>3</sub> at different ages.

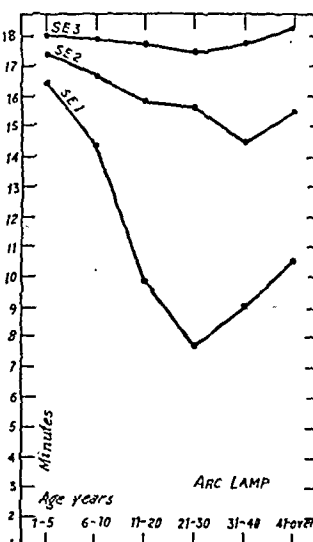


Chart BIII.  
Arc lamp test.  
Relative mean for SE<sub>1</sub> in males and females at different ages.

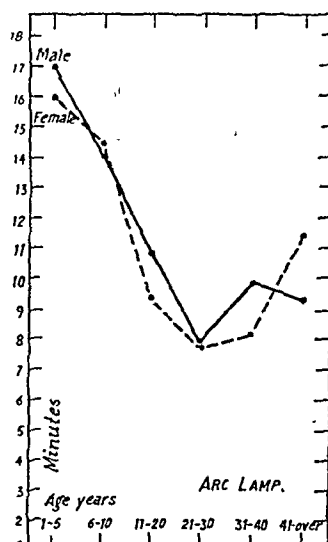


TABLE VII  
Showing the mean of SE<sub>2</sub> and SE<sub>3</sub> and number of patients at different values of SE<sub>1</sub>, for tests taken with Hanovia (standard) mercury (vide chart CI)

Value of SE <sub>1</sub>	SE <sub>1</sub>		SE <sub>2</sub>			SE <sub>3</sub>		
	Number of patients	Percentage	Number of patients	Percentage	Mean	Number of patients	Percentage	Mean
1 min.	164	19.03	161	98.1	10.4	13	7.9	17.5
2 "	58	6.8	53	91.4	10.1	21	36.0	16.0
3 "	106	11.2	96	90.6	12.3	2	1.8	17.8
4 "	42	4.8	31	73.8	13.3	..	..	18.0
5 "	70	8.1	66	94.3	12.5	..	..	18.0
6 "	19	2.2	19	100.0	12.2	..	..	18.0
7 "	36	4.2	25	69.4	14.0	..	..	18.0
8 "	7	0.8	4	57.1	14.2	1	..	1.9
9 "	26	3.02	2	7.7	17.6	..	..	18.0
10 "	14	1.7	4	28.5	16.5	..	..	18.0
11 "	31	3.7	1	3.2	17.8	..	..	18.0
12 "	7	0.8	1	14.2	17.4	..	..	18.0
13 "	24	2.8	1	4.1	17.8	..	..	18.0
14 "	8	0.9	..	..	18.0	..	..	18.0
15 "	6	0.7	..	..	18.0	..	..	18.0
16 "	..	..	..	..	18.0	..	..	18.0
17 "	..	..	..	..	18.0	..	..	18.0
Over 18 "	244	28.3	..	..	18.0	..	..	18.0
TOTAL ..	862	..	464	..	..	37	..	..

The mercury vapour lamp works with the following data:—  
Main line .. D.C. voltage 50 to 120.  
Amperes .. 3½ to 2.  
Distance .. 36 inches.

TABLE VIII

*Shows successive seuil of erythema at different ages obtained in tests taken with the Hanovia standard mercury vapour lamp (vide chart CII)*

Age in years	SE <sub>1</sub>			SE <sub>2</sub>			SE <sub>3</sub>		
	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil
1-5 ..	61	13.9	2.80	8	17.1	3.42	..	18.0	3.60
6-10 ..	82	12.5	2.50	16	16.4	3.28	2	17.8	3.56
11-20 ..	232	7.8	1.56	135	14.3	2.86	12	17.7	3.54
21-30 ..	238	6.8	1.36	150	13.0	2.60	9	17.8	3.56
31-40 ..	130	7.4	1.48	88	13.6	2.72	7	17.6	3.52
41 and over	119	7.8	1.56	67	14.0	2.80	7	17.8	3.56
TOTAL ..	862	9.5	1.90	464	14.7	2.94	37	17.8	3.56

TABLE IX

*Shows seuils of erythema in male and female children and adults (vide chart CIII)*

	SE <sub>1</sub>			SE <sub>2</sub>			SE <sub>3</sub>		
	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil	Number of patients	Mean	Seuil
Male children ..	84	12.5	2.50	18	16.8	3.36	1	17.9	3.58
Female children ..	59	13.8	2.76	6	17.0	3.40	1	17.9	3.58
Male adults ..	416	7.7	1.54	235	14.0	2.80	20	17.7	3.54
Female adults ..	303	7.1	1.42	2.5	13.0	2.60	15	17.7	3.54

Chart CI.  
Hg. lamp test.  
Relative mean of SE<sub>2</sub> and SE<sub>3</sub> at different values for SE<sub>1</sub>.

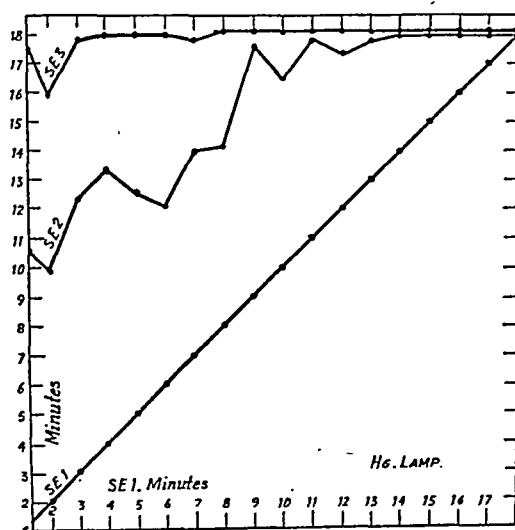
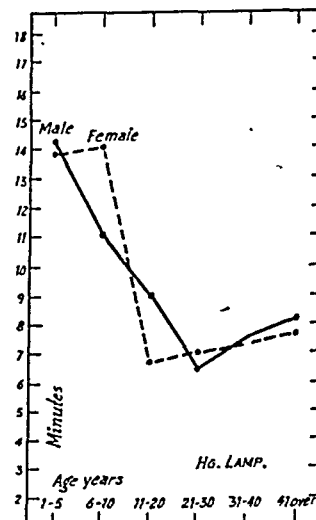


Chart CII.  
Hg. lamp test.  
Mean of SE<sub>1</sub>, SE<sub>2</sub> and SE<sub>3</sub> at different ages.



Chart CIII.  
Hg. lamp test.  
Relative mean for SE<sub>1</sub> in males and females at different ages.



*Conclusions*

1. Erythema begins to appear after three hours and takes about 8 hours to develop fully.
2. Pigment begins to appear after a week and fades away gradually after a period of two or three months.

3.

	STR	Arc lamp	Hg. lamp
SE <sub>1</sub> was seen in	55.5%	65.5%	71.7%
SE <sub>2</sub> " " "	25.5%	34.2%	53.9%
SE <sub>3</sub> " " "	8.7%	2.0%	4.3%
SE <sub>4</sub> " " "	Nil	Nil	Nil
No skin reaction "	44.5%	34.5%	28.3%

4. The skin of tuberculous patients seems to be hypersensitive and that of patients suffering from rheumatism and allied conditions is hyposensitive.

5. The most sensitive age is between 21 and 30 years and the least sensitive between 1 and 10.

6. Accustoming can be carried up to 8 to 10 times if gradually and carefully done.

7.

	STR	Arc lamp	Hg. lamp
The mean of SE <sub>1</sub> in males	11.9	9.4	7.7
" " " SE <sub>1</sub> " females	12.1	9.0	7.1
" " " SE <sub>1</sub> " male children.	15.1	15.4	12.5
" " " SE <sub>1</sub> " female children.	12.1	15.2	13.8

In the solarium we get patients mostly from Jamnagar State, which has an area of about 4,000 square miles. The State is between latitudes 22.58°N. on the north and 21.43°N. on the south and between longitudes 69.11°E. on the west and 71.34°E. on the east.

*Variations in sensibility according to sex*

The sensitiveness of the skin of adult females is about 10 per cent less than that of the male adults in India, while in France it is the reverse. In the case of children in both the countries, the sensitiveness of female children is higher by 10 per cent.

External appearance of the skin is not a sure guide with regard to its sensibility. A dark skin may sometime show a higher sensitiveness than fair skin. The skin test therefore should always be resorted to.

The skin sensitometric tests taken on a large scale in the Institutes at Paris, Aix-les-Bains and Jamnagar, have revealed very interesting facts about the skin sensibility of individuals living in two entirely different climatic conditions.

The average time taken to produce various erythema reactions is :—

	France	India
SE <sub>1</sub> ..	3.5 minutes	7.0 minutes
SE <sub>2</sub> ..	7.0 "	11.6 "
SE <sub>3</sub> ..	10.0 "	15.1 "

Indians require at least 50 per cent more ultra-violet than Europeans to produce the same effects.

*Variations in sensibility according to age*

The following table gives the diminishing order of sensibility in France and India :—

	France	India
Most sensitive age ..	20-30	16-30
	31-50	31-50
	15-20	11-25
	50-70	50-70
Least sensitive ..	10-15	6-10
	2-4	

The sensibility is variable in infants under twelve months of age. It is least in the children up to ten and highest at between 16 and 30 years. Variations according to age are similar in both the countries.

## Medical News

## THE INDIAN HONOURS LIST

2ND JANUARY, 1941

THE following are the names of medical men, and others, associated with medical institutions, in the Indian Honours List of date 1st January, 1941. We offer them our congratulations.

*K.C.I.E.*

Major-General E. W. C. Bradfield, C.I.E., O.B.E., I.M.S., Medical Adviser to the Secretary of State for India, and lately Director-General, Indian Medical Service.

*Knighthood*

Brevet-Colonel R. N. Chopra, C.I.E., I.M.S. (retired), Professor of Pharmacology and Director, School of Tropical Medicine, Calcutta.

*C.S.I.*

Major-General H. C. Buckley, K.H.F., I.M.S., lately Surgeon-General with the Government of Bombay.

*C.I.E.*

Lieutenant-Colonel H. E. Shortt, I.M.S., Director, King Institute, Guindy, Madras.

Lieutenant-Colonel H. H. Elliot, M.B.E., M.C., I.M.S., Surgeon to His Excellency the Viceroy.

Lieutenant-Colonel D. Clyde, I.M.S., Civil Surgeon, Lucknow.

Lieutenant-Colonel W. H. Crichton, I.M.S., Chief Health Officer, Delhi.

*C.B.E.*

Ruth Young, M.B.E., Women's Medical Service, lately Principal, Lady Hardinge Medical College, Delhi.

*O.B.E.*

J. R. Haddow, Indian Veterinary Service, Veterinary Research Officer-in-charge of Serology, Izatnagar.

Lieutenant-Colonel S. N. Hayes, I.M.S., Professor of Midwifery, King Edward Medical College, Lahore, and

Medical Superintendent, Lady Willingdon Hospital, Lahore.

Lieutenant-Colonel G. D. Malhoutra, I.M.S., Civil Surgeon, Moradabad.

S. R. Moolgavkar, Esq., Professor of Surgery, Grant Medical College, and Honorary Surgeon, J. J. Hospital, Bombay.

Major M. Taylor, I.M.S., Superintendent, European Mental Hospital, Kanke, Ranchi.

#### M.B.E.

Dossibai Jehangir Ratenshaw Dadabhoy, Honorary Consulting Surgeon, Cama and Albless Hospitals, Bombay.

Miss Ursula Marie Lobo, Women's Medical Service, Junior Branch, Shegaon, Buldana District, Central Provinces and Berar.

F. Barretto, Assistant Director of Public Health, in charge of the Public Health Laboratory, Poona.

Honorary Captain Rai Bahadur N. N. Dutt, Medical Practitioner, Calcutta.

Major Sayad H. Shah, Punjab Civil Medical Service, Army in India Reserve of Officers, Superintendent, Old Central Jail, Multan.

Assistant Surgeon W. St. Alban Hendricks, Civil Surgeon, Gangtok.

A. J. Noronha, Esq., Lecturer in Bacteriology and Pathology, B. J. Medical School, Poona.

Assistant Surgeon A. J. Selvey, Acting Vice-Consul and Medical Officer, British Consulate General, Kashgar.

R. S. Tirodkar, Esq., Professor of Medicine, Grant Medical College, and Honorary Physician, J. J. Hospital, Bombay.

#### Kaisar-i-Hind Gold Medal

Miss Reba Cuthbert Hunsberger, Lady Doctor-in-charge, Memorial Hospital for Women and Children, Sialkot City.

Daisy Elizabeth Munro, M.B.E., Lady Superintendent, Civil Hospital, Karachi.

R. G. Cochrane, Medical Superintendent, Lady Willingdon Leper Settlement, Chingleput.

Lieutenant W. P. S. Mitchell, M.B.E., Indian Medical Department, Chief Medical Officer, Bastar State.

Lieutenant-Colonel J. L. D. Yule, Indian Medical Service, lately Officer Commanding, Indian Military Hospital, Delhi Cantonments.

#### Bar to the Kaisar-i-Hind Gold Medal

Mrs. Olive Monahan, Chief Medical Officer (retired), Kalyani Hospital, Madras.

#### Kaisar-i-Hind Silver Medal

Robina Margaret Gertrude Brown, General Secretary, Indian Red Cross Society, Bengal Provincial Branch, Calcutta.

Winifred Cole, Rajputana.

Miss Mabel Graham, Matron of the St. Columbus Hospital, Hazaribagh, and Superintendent of the Nurses' Training School attached to the Hospital, Bihar.

Miss Ethel Mary Hadow, Zenana Mission Hospital, Tank, N. W. F. P.

Miss Ada Racine Simmonds, Nursing Sister, Church Missionary Society Hospital for Women, Multan Cantonment, Punjab.

Rai Bahadur J. P. Gupta, Provincial Medical Service, Medical Officer-in-charge, Sadar Hospital, Aligarh.

Dr. A. M. Kerr, Medical Officer-in-charge of the Mission Hospital, Jalalpur Jattan, Tehsil and District Gujarat, Punjab.

Dr. V. C. Rambo, Doctor-in-charge, Mungeli Area Christian Hospital, Bilaspur.

The Reverend D. S. Savarkar, Honorary Superintendent and Treasurer, Kondhwa Leper Hospital, Poona.

Dr. S. N. Sen, Private Medical Practitioner, Jamalpur, Honorary Ophthalmic Surgeon to Monghyr Sadar Hospital, Bihar.

Dr. B. K. Sikand, lately Secretary, Tuberculosis Association of India, New Delhi.

Dr. The Reverend C. Wyder, Superintendent, Kothara Leper Asylum, Ellichpur Taluq, Amraoti, Central Provinces and Berar.

#### Bar to the Kaisar-i-Hind Silver Medal

Lucia Navamanie Veerasinghe Chinnappa, Assistant Directress of Public Health (Maternity and Child Welfare), Madras.

Miss Elizabeth McMaster, Principal Doctor of the Canadian Mission Hospital for Women, Indore.

The Reverend P. A. Penner, Superintendent, Bethesda Leper Home, Champa, Bilaspur District.

#### Kaisar-i-Hind Bronze Medal

Sister Marie Cecile, Matron, St. Teresa's Hospital for Women, Kurnool, Madras.

Dr. K. W. Advani, Medical Practitioner, Sind.

Dr. N. Angami, Sub-Assistant Surgeon, Kohima, Naga Hills.

Jemadar P. Singh, Indian Medical Department, Sub-Assistant Surgeon, King George's Royal Indian Military School, Jullundur.

Jemadar Syed R. Ahmad, Sub-Assistant Surgeon, Indian Medical Department, in charge British Consulate Hospital, Zabul, Iran.

Dr. N. B. Sen Gupta, Sub-Assistant Surgeon in charge of the Leper Asylum, Sylhet.

Dr. T. R. Tewari, Punjab Civil Medical Service, Assistant Surgeon, Punjab.

#### Khan Bahadur

Khan Sahib Shaikh Ghulam Muhammad, Assistant Inspector-General of Civil Hospitals, Punjab.

Khan Sahib Risaldar H. M. Suleman Bahadur, O.B.I., Indian Army Veterinary Corps (retired), Military Veterinary Hospital, Poona.

#### Rai Bahadur

Rai Sahib S. C. Ghosh, Honorary Surgeon, Medical College Hospitals, Calcutta.

Rai Sahib M. P. Mehra, in charge Khairabad Eye Hospital, Sitapur District.

Dr. R. N. Darbari, Medical Practitioner, Allahabad.

Dr. Lala G. D. Kapur, Clinical Assistant to the Professor of Surgery, King Edward Medical College, Lahore.

Rai Sahib N. Pal, Lecturer in Surgery, Prince of Wales Medical College, Patna.

Rai Sahib S. B. Dutta, Civil Surgeon, Saran, Chapra.

Dr. B. Sen Gupta, Civil Surgeon, Balasore.

#### Rao Bahadur

Dr. M. J. P. S. Pillai, Medical Superintendent, Barnard Institute of Radiology, Madras.

Dr. A. T. Nayudu, Assistant Director of Public Health, Madras.

Dr. R. A. Kalle, Civil Surgeon, Bijapur, Bombay.

Dr. R. C. Motwani, Professor of Anatomy, Grant Medical College, Bombay.

Dr. B. R. Chandorkar, Civil Surgeon, Bhandra, C. P.

Rao Sahib M. Ramaswamy, Honorary Secretary, Indian Red Cross Society, Bangalore City Branch, Mysore.

#### Shifa-ul-Mulk

Hakim A. Usmani, Member, Board of Indian Medicine, Allahabad.

Hakim M. H. Khan, Proprietor, Chashma-i-Hayat Pharmacy, Ajmer.

#### Vaidyaratna

Kaviraj P. Sinha, Superintendent, Ayurvedic College, and Professor of Pharmacy, Hindu University, Benares.

#### Khan Sahib

S. Zainalabadin, Esq., Civil Assistant Surgeon, Kyaiklat, Burma.

A. M. Naqui, Esq., State Surgeon, Barwani State, Central India.

Jemadar M. G. Ali, Indian Medical Department, Sub-Assistant Surgeon, His Excellency the Viceroy's Dispensary.

*Rai Sahib*

Dr. A. B. L. Mathur, Lecturer, Medical College, Agra.

Dr. J. L. Agarwala, Medical Officer-in-charge, Kalyan Eye Hospital, Khatauli, U. P.

Dr. G. Sahay, Assistant to the Civil Surgeon, Patna, Medical Officer-in-charge, Patna Police Hospital, and Lecturer in Medical Jurisprudence, Patna Medical College.

Dr. K. B. Sahay, Teacher of Pathology and Deputy Superintendent, Darbhanga Medical School, Laheria Sarai.

Dr. S. N. Mukharji, Private Medical Practitioner, Deogarh.

Dr. S. N. Malhotra, Chief Medical Officer and Sanitary Commissioner, Karauli State.

Pandit R. R. Shukla, Sub-Assistant Surgeon, Medical Department, Ajmer-Merwara.

Dr. A. B. Sen, Assistant Surgeon, A. B. Railway, Chittagong.

*Rao Sahib*

Dr. D. R. Annamalai, Civil Assistant Surgeon, King Institute, Guindy.

Dr. A. Y. Deshpande, Ellichpur, Amraoti District, C. P.

Dr. T. H. Trivedi, Pathologist, West Hospital, Rajkot Civil Station, Western India States Agency.

Dr. M. N. Vijaykar, Medical Superintendent, Antop Village, Port Trust, Bombay.

## TUBERCULOSIS WORKERS' CONFERENCE

THIS year, as last year, the value of the conference was proved, not only by the papers read and the discussions which followed, but perhaps even more by the personal intercourse between the members coming from all parts of India, by the opportunity for sharing individual problems, and by the inspiration of the growing feeling that they were all banded together in one brotherhood in the campaign against tuberculosis in this country.

## SUMMARY OF PAPERS AND DISCUSSIONS

*'The Progress of the Tuberculosis Association's Campaign against Tuberculosis in India'* by Lieut-General G. G. Jolly

The paper summarized briefly the present stage in the campaign against tuberculosis in India, from the point of view of the central association, since February 1939, the date of the inauguration of the association. The establishing of contacts with provincial and state committees, with government and local authorities and with tuberculosis workers, was one of the first steps. General Jolly paid a tribute to the help of Lady Linlithgow in this respect. The tours of the medical commissioner had also been of the utmost value. Thirteen provincial and eleven state associations were now affiliated to the centre, and several more associations were in process of formation. There had been a rapid growth of tuberculosis institutions, but there was so far a lack of after-care. Of the two institutions to be run by the centre, the model clinic in New Delhi was complete, and the Kasauli sanatorium was being begun. Short courses of post-graduate training in tuberculosis for general practitioners had been held in Bombay, Calcutta and Madras; Madras had also begun a 5 months' diploma course in tuberculosis. The paper also touched on the training of tuberculosis health visitors, tuberculosis propaganda and the need of a good India tuberculosis film, and tuberculosis surveys. Organized home treatment had been suggested by the central committee as a policy practicable at the present stage of the development of the campaign and in this the general practitioner had a prominent place.

*Discussion*

This ranged over a large number of subjects connected with various aspects of tuberculosis work in India. Foremost in the discussion was the place of private practitioners in the tuberculosis campaign; their co-operation was absolutely essential, but in order that this

co-operation might be obtained it was necessary that doctors in charge of clinics should not be allowed private practice; the system of staffing clinics with honorary doctors was impracticable; the non-co-operation of private practitioners was in some case due to fear of losing their patients.

Another subject discussed was the necessity of co-operation between the public health department and tuberculosis workers, specially as improvement of housing and living standards had to have a place in the tuberculosis campaign.

The place of the central association also came up for discussion, specially as regards the help that it could afford in such work as the planning and advising about surveys, and the allotting of research to different institutions to avoid overlapping and duplication specially when funds were very limited.

Other subjects which found a place in the discussion were the training of tuberculosis workers, doctors and health visitors, and of medical students in tuberculosis; the question of what to do with soldiers discharged from the army as tuberculous; the need of after-care establishments; mobile instead of fixed dispensaries in some areas; the provision of isolation for the poor in organized home treatment.

Several speakers dealt with legislation as regards notification with a view to checking spread of infection, but some thought this too early at the present stage of the campaign in India.

*Tuberculosis Surveys*

## (a) Paper by Dr. R. B. Lal

The tuberculosis survey is an investigation into the social and other factors determining the peculiar distributions of the disease in the community and their trends and also into the potential forces which aid or combat the dissemination of the disease and determine its types. Only on the basis of the results of a survey so defined can a campaign best suited to the community be devised in a rational manner. The paper then dealt with some of the general principles in the methods of approach in pursuit of the objects of a survey and some of the general principles of practical importance in the planning and execution of survey so necessary if the effort of the survey is not to be largely wasted.

## (b) Paper by Dr. P. V. Benjamin

The main purpose of tuberculosis surveys is the gathering of knowledge which can be used for the prevention of the disease. In the process of a complete survey there are several stages which are: type I survey for ascertaining the distribution of tuberculous infection in a particular community or area; type II survey including also extent of morbidity and mortality, extent of contact infection and the forms and types of disease; type III survey for investigating the factors which influence infection, morbidity and mortality. Each of these surveys was described and illustrated from such surveys made in S. India by the speaker and his colleagues. He then summed up the experiences and lessons gained from these surveys; definite knowledge about tuberculosis in these areas had been acquired and this could be used for gaining public co-operation in the campaign; the well-to-do are infected as much as the poor; except in a type I survey, a clinic is necessary for taking care of detected cases and thereby helping to sustain public interest and co-operation; a survey must be made to search for infective cases not coming to a clinic; for some for whom home treatment is impossible, a simple form of isolation will be necessary outside the home.

*Discussion*

There was stressed the necessity of surveys being carried out by well-trained workers, the type of test to be used—von Pirquet or Mantoux—the comparative value of fluoroscopy and radiography and the use of miniature films in surveys, the need for surveys being based on well-established institutions, and the need for help from the central association in advising, planning and assessing surveys, were all brought out in the discussion.



The second day of the conference was taken up with the subject of the influence of environmental factors on tuberculosis.

*'The Influence on the Incidence of Tuberculosis by By-laws concerning Buildings, Town Planning, Slum Clearance and Lodging Houses'* by Lala Shri Ram, Vice-chairman of the Tuberculosis Association

Municipalities when first constituted had to face only a few simple problems, such as providing a water-supply, lighting and indispensable sanitary services, but now they were faced with the great responsibility of safeguarding and improving public health in their areas. Housing conditions had to be regulated; new buildings could be regulated by building by-laws, but old buildings could only be dealt with by a town improvement scheme. Even where building regulations existed, a popularly elected body often found great difficulty in enforcing them and contraventions were frequently condoned. The town councils should lay down the policy, and the executive staff should then be held responsible for any breaches that occurred. The financing of improvement schemes to open up slums and remove sources of infection was not easy. Under the scheduled tax rules, municipalities had been allotted a few specific items of taxation when the needs were few and primitive, but a revision of tax allocation was now necessary. Town improvement schemes and the developing of a civic conscience by propaganda would all help in the reduction of tuberculosis.

*'The Influence of Environment on the Incidence of Tuberculosis'* by Lieut.-Colonel E. Cotter

The general features of the epidemiology of tuberculosis have long been known and the factors influencing its incidence can be summed up under nutrition, housing and education. After illustrating the influence of these three factors mainly from investigations in Europe, the paper went on to deal with some constructive suggestions as to what could be done in India. As regards nutrition, the results of researches under the Indian Research Fund Association had now to be applied to the general population by provincial and state authorities in which agricultural and health authorities co-operate. As regards housing, cities, small towns and villages had their different problems; the Delhi improvement trust scheme financed by the proceeds of the entertainment tax was a good example of what could be done in a city; a simpler plan was required in rural areas, the Nazafgarh scheme being an example of this. As regards education, it was hoped that the report of a special committee on health education in schools under the Central Advisory Board on Health, would be of value when it is published.

#### Discussion

A full discussion followed in which not only tuberculosis workers took part but also representatives of public health departments, municipalities, the army and railways. A full description of the Delhi improvement trust scheme was given by the chairman of the trust. Among the points brought out in the discussion were: the necessity not just for slum clearance, but for re-housing those removed from the slums; the problems caused by the drift of population from the country to the town; the main danger is the infectious case plus local overcrowding and therefore case-finding cannot be neglected; the need for a much wider co-operation between public health, medical and educational departments; education needed for both provincial and local authorities in matters concerned with the spread of tuberculosis; the need for health officers to have power with regard to sanctioning new buildings. The neglect of housing for domestic servants, the influence of purdah, that overcrowding is not always associated with poverty, were also mentioned.

General Jolly, in summing up the day's discussion, said it had been exceedingly productive and exceedingly interesting. *The improvement trust system* was not new, but the application of a luxury tax to pay for housing the poor was a new idea. Enforcement of

by-laws was a crucial point and to ensure this a scheme similar to that in Burma was suggested in which—

- (1) There was security of tenure for the health officer.
- (2) Local authorities had responsibilities and not merely powers to make by-laws for buildings, which had to be submitted to the local government, i.e., the passing of acceptable by-laws was mandatory, not permissive.
- (3) It was the duty of the health officer to enforce the by-laws dealing with public health passed by the municipality.

The remaining day and a half of the conference were occupied with technical papers.

*'Classification of Pulmonary Tuberculosis on Admission and Discharge'* by Dr. C. Frimodt-Møller

In a very brief paper the report of the sub-committee on the classification of pulmonary tuberculosis appointed by the Tuberculosis Association was introduced and was further explained by Dr. P. V. Benjamin.

#### Discussion

Suggestions were made for a system of marks for different criteria taken in assessing stages, but the difficulties of doing this in the present stage of our knowledge and in the present stage of tuberculosis work in India, were brought out. The question whether the pathological type of the lesion should be taken into consideration as well as the anatomical extent of the disease was discussed. The necessity of x-ray examination for a satisfactory classification was well emphasized. In 'discharge' results there was discussion about the classifications of 'arrested', 'much improved' and 'improved', and an additional classification of 'quiescent' was suggested.

*'Hæmoptysis'* by Dr. K. Vasudeva Rao

After stating that in a series of 3,082 cases treated in Madras, 38.6 per cent had hæmoptysis of which only 9.4 per cent were severe, the paper dealt with the causation of hæmoptysis, the classification of hæmoptysis, the time of onset, seasonal variations, epidemic form, and age and sex influence. Prognosis and general management and a review of the methods used to control bleeding, medical and surgical, concluded the paper.

#### Discussion

In a short discussion the comparative rarity of deaths from hæmoptysis was mentioned by some speakers. A doubt was expressed as to the value of the many drugs advocated for hæmoptysis. Seasonal variation had also been noted by several.

*'Interpretation of X-ray Films in Pulmonary Tuberculosis'* by Dr. A. C. Ukil

The paper emphasized the necessity for proper exposure and developing of x-ray films if a reliable interpretation is to be made. In examining a film the following points had to be borne in mind:—

- (1) The general appearance of tissues and organs in the thorax.
- (2) The localization of the shadows.
- (3) The character of the shadows, both in general and from the point of view of tuberculosis.
- (4) The character of striation in the lung fields.
- (5) Deficiency of the normal shadow and its localization and character.
- (6) Differential diagnosis.

After the paper a number of x-ray films were demonstrated to illustrate the paper.

*'Tuberculosis and Diabetes'* by Dr. R. B. Billimoria

The paper dealt with the pathology of tuberculosis associated with diabetes and gave a short outline of the treatment to be adopted both for the diabetes and the tuberculosis, treatment of both being equally important.

*'Intestinal Tuberculosis in its Medical Aspects'* by Dr. R. Viswanathan

The paper began with a statement of the frequency of intestinal tuberculosis as a complication of pulmonary

tuberculosis seen at Vizagapatam and then dealt with the pathological anatomy of the condition and reviewed the treatments advocated. Some pathological specimens and lantern slides were shown at the end of the paper.

*'Abdominal Tuberculosis in its Surgical Aspects'* by  
Lieut.-Colonel F. J. Anderson

The speaker considered not only intestinal tuberculosis but also other forms of abdominal tuberculosis and spoke of the types of operation he had found of benefit.

*Discussion*

There was a difference of opinion as to whether intestinal tuberculosis was to be treated primarily medically or surgically, but probably no clear-cut division could be made and some cases must be treated surgically and some benefited best by medical treatment. Some speakers dealt with treatment by pneumo-peritoneum with or without a preliminary incision through the abdominal wall. The frequency of intestinal tuberculosis was commented on by several, both as a primary and a secondary manifestation. The difficulty of differential diagnosis was also mentioned and caution in the interpretation of x-ray films after barium meal was urged.

This year the conference was noted for the keenness and high level of the discussions which followed the papers, and the large number of speakers who took part.

*Resolution passed by the committee of experts appointed by The Tuberculosis Association of India in regard to general conditions which should govern the selection of sites for tuberculosis clinics*

- (1) 'What considerations should govern the selection of sites for tuberculosis clinics?'

The site for a tuberculosis clinic should be selected with a view to its being of the greatest help to the population which it is intended to serve. This will be in, or as close as possible to, the most thickly populated area of the locality.

- (2) 'Is it necessary to require any conditions to be satisfied by sites in or near populated areas in respect of either distance from inhabited houses or any other matter as a precaution against the spread of infection?'

No conditions need be laid down with regard to the distance of a clinic from inhabited houses in or near a populated area if the clinic is properly conducted. If a section of a building which is used for other purposes is selected for a clinic, the clinic should have its own separate entrance.

**THE INDIAN CHEMICAL MANUFACTURERS' ASSOCIATION, CALCUTTA**

THE necessity of according to the manufacturers of chemical and pharmaceutical products the facility to have a clinical trial of their products in the hospitals under the control of Government and local bodies, has been stressed in the course of a communication addressed by the Indian Chemical Manufacturers' Association to all the provincial Governments and major Indian States. It is pointed out that this facility is available in foreign countries and it has helped to obtain for the products manufactured in those countries the proper markets, whereas the absence of this facility in India forms one of the greatest handicaps to the industry. Recently the Medical Research Association in the U.K. in conjunction with Government departments and the Association of British Manufacturers arranged clinical trials of several important synthetic remedies previously obtained from abroad but now being manufactured in Great Britain, in order to ensure that these drugs of British manufacture were equivalent to the corresponding imported products. The Chemical Association states

that several drugs and proprietary remedies identical to those coming from Germany and other foreign countries are now being manufactured in India and the manufacturers are in a position to prepare many more also, but the absence of the facility of clinical test makes it difficult to convince the medical profession and the buyers about the products of Indian manufacture being equally as efficacious as the corresponding foreign medicines, which are looked upon as standard. The facility of clinical trial in India would make it possible for many foreign medicines to be replaced by indigenous ones thus helping the chemical and pharmaceutical industry in this country.

**THE INDIAN CHEMICAL MANUFACTURERS' ASSOCIATION, CALCUTTA**

As a result of the efforts of the Indian Chemical Manufacturers' Association, Calcutta, the Government of India have decided to exempt benzol used in the manufacture of medicinal preparations from excise duty. The Government of India levied an excise duty of As. 10 per gallon (subsequently increased to As. 12) on benzol on the ground that it can be used as motor spirit as a substitute for petrol. The Indian Chemical Manufacturers' Association had pointed out to the Government that benzol was used as a solvent in the manufacture of alkaloid preparations but on account of the excise duty the alkaloids prepared in India could not stand in competition with the imported alkaloids in normal times. The step now taken by the Government of India would enable utilization of a large quantity of benzol manufactured in coke oven plants which was till now going to waste. It would also give an impetus to the manufacture of alkaloid preparations in this country.

**ABSTRACT OF THE MINUTES OF THE BENGAL COUNCIL OF MEDICAL REGISTRATION, DATED 16TH FEBRUARY, 1940**

1. THE Council had at their meeting of 8th August, 1939, adopted a resolution that it was desirable that the country of qualification, particularly when the qualification had been obtained from a foreign country, should be mentioned along with the abbreviation used for medical degrees, so that the public might not be misled; and expressed hope that a convention would be gradually established by registered medical practitioners, if they followed this practice.

The question whether this should be included in the Penal and Ethical Rules was considered at the meeting of 16th February, 1940: and it was decided that though desirable this could not or need not be included in these rules.

2. On a reference made to the Council on the question as to the propriety or otherwise of supplying personal history of patients in a hospital, such as one for tuberculosis, to life insurance companies, the Council observed that Rule 19 in Part III of the Council's Penal and Ethical Rules was clear enough on the subject and that it would not be proper for the authorities of such hospital to supply personal history of patients treated therein to such companies. The rule is as below:—

'A medical practitioner is under an obligation to his patient to preserve his secrets and in legal matters should, except with the patient's consent, answer questions only at the express direction of the Judge or Magistrate presiding in a court of law. A medical practitioner is not bound to answer questions put to him by policemen except as provided in section 44 of the Criminal Procedure Code.'

3. The Council noticed with regret that an amendment of the Bengal Medical Act, on the lines suggested by the Council from time to time, had not yet been taken up by the Government. They also desired to impress upon Government the necessity of improving the standard of Licentiatehip course, by raising the

preliminary qualification to I.Sc., and extending the period from 4 years to 5 years.

4. The Council also resolved that the departments of the Government of India such as the posts and telegraphs, income-tax, etc., should be requested to follow the Government of Bengal Circular No. 2556 dated the 8th September, 1921, which lays down that when a medical certificate has been given to a non-gazetted officer by a registered practitioner, no further examination by the civil surgeon or a higher medical officer should be required unless the genuineness or veracity of the certificate was doubted.

#### ABSTRACT OF THE MINUTES OF THE BENGAL COUNCIL OF MEDICAL REGISTRATION, DATED THE 13TH AUGUST, 1940

1. THE Council repeated their recommendation that with a view to restraining quack practice, all dispensaries should be licensed and no dispensary should dispense any preparation which is not signed by a practitioner possessing registrable qualification.

2. The Council repeated their recommendation for suitable measures forbidding the use of the prefix 'Dr.' as a medical qualification except by persons possessing registrable qualifications.

3. On the question of propriety of registered practitioners being directors of firms manufacturing medicines, the Council adopted the following resolution:—

'That this Council would not object to the mere association of medical practitioners with firms of manufacturing medicines, whether as directors or shareholders, but the names of such medical practitioners should not appear in any publication (such as catalogue of prices or advertisements) circulated to the general public by the firm or its agents.'

4. The Council amended their Ethical Rule 8 as follows:—

'When a medical practitioner is asked to see and report on a case of illness or injury of a person who is under the care of another registered practitioner or about whom the latter has already given a medical certificate, the former should in all cases give the latter an opportunity to be present at the time of examination, if he so liked: and for this purpose he should direct the patient to inform the latter practitioner in sufficient time.

The medical practitioner when so seeing or reporting on a case, shall not interfere with the treatment nor make any disparaging remarks about the first diagnosis and treatment, even though he might differ.'

5. Certain cases of medical certificates being given by practitioners without sufficient care were reported and the practitioners were warned by the Council.

6. On the question of registered practitioners teaching medical subjects in Ayurvedic institutions, the following resolution was adopted qualifying section 3, Part I of the Ethical Rules:—

'This section does not apply so as to restrict the teaching of pre-clinical subjects such as anatomy and physiology by registered practitioners, in institutions recognized by the Ayurvedic State Medical Faculty of Bengal.'

7. The Council decided to add a chapter at the end of the *Annual Medical List* giving a list for the general information of all practitioners showing references to various provisions in the law which impose certain legal obligations on them and penalties for default.

#### APPENDIX TO THE PROCEEDINGS OF THE PENAL AND ETHICAL CASES COMMITTEE, DATED THE 22ND JULY, 1940 (ITEM 5). PART IV

##### *Some legal matters of general information for medical practitioners*

#### 1. Calcutta Municipal Act, 1923 (as amended)

Section 435: Every medical practitioner who, in the course of his practice, becomes cognizant of the existence of any dangerous disease in any private or public dwelling-house, other than a public hospital, shall give

information of the same with the least practicable delay to the health officer in such form and with such details as the health officer may, from time to time, require.

'Dangerous disease' means—

- (a) cholera, plague, smallpox, cerebro-spinal meningitis and diphtheria; and
- (b) any other epidemic, endemic or infectious disease which the local government may, by notification in the *Calcutta Gazette*, declare to be a dangerous disease for the purpose of this Act.

Penalty for default, fine Rs. 50

Section 453: Any medical practitioner in attendance during the last illness of any person dying in Calcutta shall, within three days of his becoming cognizant in the course of such attendance of the death of such person, send a written notice to the health officer, as nearly as may be in the form prescribed in Schedule XXII, stating, to the best of his judgment, the cause of death.

Penalty for default, fine Rs. 50

#### 2. Bengal Municipal Act, 1932

Section 377: A medical practitioner or a person practising the medical profession, and in the course of such practice becoming cognizant of the existence of any dangerous disease in any building other than a public hospital . . . shall give true and correct information to such officer as the commissioner may direct, respecting the existence of such disease.

Penalty for default, fine Rs. 50

Section 447: Whenever a birth or death occurs in any hospital within the limits of any municipality in respect of which the local government has directed that all births and deaths shall be registered under the Bengal Births and Deaths Registration Act, 1873, it shall be the duty of the medical officer in charge of such hospital forthwith to send a notice in writing of the occurrence of such birth or death to the commissioners in such form as the local government may prescribe, and in such case no other person shall be required to give information of such birth or death to a registrar under the said Act or to a sub-registrar under this Act.

Penalty for default, fine Rs. 50

#### 3. Bengal Vaccination Act, 1880

Section 5: If any . . . medical practitioner shall be of opinion that any child is not in a fit state to be vaccinated, he shall forthwith deliver to the parent or guardian of such a certificate under his hand according to the form of Schedule A hereto annexed or to the like effect, that the child is then in a state unfit for vaccination.

Section 6: If any . . . medical practitioner finds—

- (a) that a child brought for vaccination has already had smallpox, or
  - (b) that a child who has been three times unsuccessfully vaccinated is insusceptible of successful vaccination,
- he shall deliver to the parent or guardian of such child a certificate under his hand, according to the form in Schedule B hereto annexed, or to the like effect.

Penalty for not giving certificate Rs. 50; for giving false certificate, up to 6 months' imprisonment and fine Rs. 100 (section 28)

#### 4. Dangerous Drugs Act, 1920

A medical practitioner possessing or selling medicinal opium or of any preparation containing morphine, diacetyl-morphine, or cocaine, in contravention of the Government rules prescribing the limits.

Penalty up to 2 years' imprisonment and fine

#### 5. Poisons Act, 1919

Contravening the Rules under the Poisons Act.

Penalty up to 3 months' imprisonment and fine Rs. 500

## 6. Bengal Excise Act

*Section 18:* Possession of any intoxicant which has not been obtained from a licensed vendor . . . .  
 ['Intoxicant' means the leaves, small stalks and flowering tops of Indian hemp plant (*Caralis sativa* L.) including *bhang*, *siddhi* or *ganja*; *charas*: any mixture with or without neutral materials, if any of the above forms of intoxicating drug or drink made therefrom: and any other intoxicating or narcoting substance or any fermenting against which the provincial Government may specify as 'intoxicant'.]

Penalty up to 6 months' imprisonment and fine Rs. 1,000

*Section 53:* If any chemist, druggist, apothecary or keepers of a dispensary allows any intoxicant which has not been *bona fide* medicated for medicinal purposes, to be consumed in his business premises by any person not employed in his business.

Penalty up to 3 months' imprisonment and fine up to Rs. 1,000

## 7. Indian Port Health Rules, 1938 (Under the Indian Ports Acts, 1908)

*Rule 8:* 'Every medical practitioner, who becomes cognizant that any passenger on board or any member of the crew or any person employed on board any vessel in the port is suffering from any of the diseases specified in rule 3, shall immediately give notice thereof by telephone and in writing to the Health Officer.'

(The diseases specified in rule 3 are plague, cholera, yellow fever, typhus, smallpox, chickenpox, cerebro-spinal meningitis, diphtheria, relapsing fever, jigger, and influenzal pneumonia.)

Penalty for omission, fine up to Rs. 1,000 [section 6(3)]

## 8. Indian Penal Code

*Section 269:* Whoever unlawfully or negligently does any act which is, and which he knows or has reason to believe to be likely to spread the infection of any disease dangerous to life.

Punishment up to 6 months' imprisonment and fine  
*Section 274:* Adulteration of drug or medicinal preparation.

Penalty up to 6 months' imprisonment and fine Rs. 1,000

*Section 275:* Selling or offering for sale the same.

Penalty up to 6 months' imprisonment and fine Rs. 2,000

*Section 276:* Whoever knowingly sells or offers or exposes for sale or issue from a dispensary for medicinal purpose any drug or medicinal preparation, as a different drug or medicinal preparation.

Penalty up to 6 months' imprisonment and fine Rs. 1,000

*Section 284:* Whoever does, with any poisonous substance, any act in a manner so rash or negligent as to endanger human life, or to be likely to cause hurt or injury to any person; or knowingly or negligently omits to take such order with any poisonous substance in his possession as is sufficient to guard against probable danger to human life for such poisonous substance.

Penalty up to 6 months' imprisonment and fine Rs. 1,000

## INDIAN JOURNAL OF OPHTHALMOLOGY

We have now received the second number of this journal. There was room for a specialist journal on this subject in India and we welcome its publication.

The articles are interesting, particularly one long historical paper on cataract.

The format of the journal is good, and the proof reading has obviously been done carefully; however most of the references are not given in a traceable form, the year only being mentioned in some cases.

We wish the journal the success that the enterprise of its promoters deserves.

## Current Topics

## Antiseptic Analgesic Tannic-Acid Jelly for Burns

By J. F. HEGGIE

and

R. M. HEGGIE

(From the *Lancet*, Vol. II, 28th September, 1940, p. 391)

WHEN we were considering the use of an antiseptic tannic-acid jelly for burns in H. M. ships, in which bottles of tannic-acid solution might readily be broken in action at dressing-stations, Prof. W. C. Wilson of Aberdeen told us that he had had prepared for him in the dispensary at Edinburgh Royal Infirmary a jelly consisting of acriflavine 0.1 per cent and tannic acid 20 per cent with a glycerine-tragacanth base.

We prepared a similar jelly with proflavine sulphate 0.1 per cent, and, having regard to the use of Nikalgin for burns in the last war, we considered the addition of an analgesic. Tannic acid precipitates alkaloids from solution, but its effect in a jelly was considered to be less rapid; so quinine and urea hydrochloride 0.5 per cent were added. Slow precipitation took place, and chlorbutol 2 per cent and procaine 2 per cent were substituted in separate preparations. Chlorbutol gave very little relief. Procaine gave relief lasting about an hour and has been used more frequently.

Since in the great majority of infected burns reaching this hospital the predominating organism was *Staphylococcus pyogenes aureus*, the jelly was also

made up with methyl violet 0.1 per cent instead of proflavine sulphate. Our observations on the organisms normally present on the skin of naval ratings have proved that pyogenic staphylococci are commonly found.

The formula for the jelly is as follows:—

Tannic acid	..	20.0 per cent.
Proflavine sulphate	..	0.1 "
Procaine	..	2.0 "

in glycerine-tragacanth base.

Methyl violet may be substituted for proflavine sulphate. The glycerine-tragacanth base consists of:

Pulv. tragacanthæ co.	..	2.0 per cent.
Glycerine	..	10.0 "
Distilled water	..	ad 100 "

The preparation is put up in collapsible tubes or, in hospital, stored in wide-necked well-stoppered bottles.

## APPLICATION

*On unbroken skin.*—When the skin is erythematous and blisters have formed, the jelly is smeared fairly liberally over the affected area and well over the margin on to healthy skin. Two thicknesses of gauze are then applied intimately, another two are added, and with a thickness of wool the whole is bandaged and left for about a week. This was the routine adopted in the cases we have treated personally.

On the removal of the dressing at the end of a week the consistence of the jelly had altered according to

the amount of evaporation and varied from that of an unguent to peeling flakes. Practically no damage was done to the tissues on removal of the gauze, which came away easily. In areas over which blisters had formed the hygroscopic action of the glycerine had caused the blister fluid to be withdrawn into the dressing; the wrinkled superficial epithelium covered the area. The surrounding skin was slightly dyed. None of these burns became infected.

*On broken skin.*—The jelly was applied in the same way as for unbroken skin. Where the blisters had ruptured a good tan-coagulum formed. This was separated at the end of ten to fourteen days, and the skin beneath, though thin, was soundly healed. The gauze incorporated in the coagulum facilitated its removal. None of these burns became infected. The tanned area, however, wherever joints were not involved, formed a continuous sheet; consequently there were no cracks. In two cases the burns affected the extensor and flexor aspects of the wrist. In these two cases no wool was used over the gauze dressings. The jelly dried fairly quickly, a good coagulum formed, and cracks developed. A slight amount of purulent exudate was noted, two days later, at the edges of the cracked tan. The patient, who complained of sore-throat, was observed on occasion to use his hand and wrist to shield his mouth on coughing. Bacteriological examination showed staphylococci (coagulase and

haemolysin-positive) present in the fauces and in the exudate from the wrist.

*On fingers and hands.*—Owing to the constricting effect of the tan on burns encircling fingers and hands completely, the tannic-acid jelly has not been used on such parts. Instead we recommend the use of a jelly of the following composition:—

Gentian or methyl violet	1.0 per cent.
Quinine and urea hydrochloride	0.5 "
in glycerine-tragacanth base	
(put up in collapsible tubes).	

We have not yet had an opportunity of using this jelly, but gentian violet has been used by others as an antiseptic and coagulating agent in burns.

#### COMMENT

This tannic-acid jelly appears to have several advantages. Apart from its antiseptic and analgesic qualities, the hygroscopic action of the glycerine in withdrawing the blister fluid is beneficial in making resorption of this fluid impossible. Bacterial growth is diminished by this action of the glycerine and by increased penetration and concentration of the antiseptic dye.

We are trying to obtain a jelly which will make for equal ease in dressing and produce a pliable softer incrustation rather than the rigid tannic-acid eschar.

## Reviews

**A GUIDE TO HUMAN PARASITOLOGY FOR MEDICAL PRACTITIONERS.**—By D. B. Blacklock, M.D. (Edin.), D.P.H. (Lond.), D.T.M. (L'pool), and T. Southwell, D.Sc., Ph.D., A.R.C.Sc., F.Z.S., F.R.S.E. Fourth Edition. 1940. H. K. Lewis and Company, Limited, London. Pp. viii plus 259, with 122 illustrations and 2 coloured plates. Price, 12s. 6d.

To produce a book of this kind needed courage and could only have been undertaken by men whose reputations are established beyond question as are those of both authors. The authors are, or were, teachers on the staff of the Liverpool School of Tropical Medicine and are used to teaching post-graduate students; they are therefore unlikely to underestimate the capacity of the student to learn this subject. Yet, parasitology has been reduced by them to a much simpler and more practical form than one finds in most textbooks designed for students. The question arises, 'Are the authors right?' or 'Have they overdone the simplification?' We unhesitatingly give the verdict in favour of the authors. We are obviously not alone in our opinion, for this is the fourth edition, one edition having been reprinted, since the book was first published in 1931.

The book is essentially what the title claims for it; it is in no sense a textbook, but a *guide*. It will help the specialist only in so far as his teaching is concerned, but the practitioner will find in it all he will want to know about the diagnosis of the parasitic infections he is likely to encounter in his daily work, and sufficient about the life cycles of the parasites to enable him to institute preventive measures, when he has an opportunity to do so.

As far as protozoology is concerned, the sixty pages devoted to this will be sufficient for the qualifying and M.B. examinations, but for post-graduate examinations, such as the L.T.M. and D.T.M., a certain amount of supplementation will be necessary. The helminthological portion is however quite sufficient for either of these examinations.

No essential changes have been effected in this fourth edition, and few additions made, as it is not the type of book that becomes out-of-date readily, so that we cannot recommend those who have an earlier edition to buy the book, but we do very strongly recommend

it to those not already familiar with it. Teachers in medical schools and colleges will find the tables and diagrams, which are a prominent feature of the book, invaluable.

**A SYMPOSIUM ON THE BLOOD AND BLOOD-FORMING ORGANS.**—By various authors. 1939. The University of Wisconsin Press, 811, State Street, Madison, Wisconsin. Pp. viii plus 264. Illustrated. Price, \$3.50

SYMPOSIA have a way of being very disappointing and the reason is fairly obvious. When an individual writes a paper in a journal, it is usually because he has something he wishes to announce to the world, the results of a laboratory investigation or a series of clinical observations, or a theory he has formulated; he usually does this in his own time on his own initiative. Not so in the case of a symposium—being an authority on some particular subject, a worker is asked if he will contribute a paper on this subject, and, though he may have nothing new to say, he hashes up some of his old published work, adds a new observation here and there, and presents his hot-house plant in order not to disappoint his friends, or, in some cases we are afraid, because he feels he must keep his name before his public and the occasion is too good an opportunity to miss.

This is not such a symposium; on the contrary with very few exceptions the papers are very live contributions to a very virile subject by men who are actively engaged in studying the blood, its functions, and its dysfunctions. Contributors include C. P. Rhoads, Russell L. Haden, C. A. Doan, E. E. Osgood, Claude Forkner, E. B. Krumbhaar, and E. Meulengracht.

Haden's study of the nature of hæmolytic anæmia is particularly interesting and is very characteristic of work of this direct thinker. He starts with the red cell, its envelope, stroma, and contents, and points out that the assumption of the spherical shape allows a much bigger content for the same size of envelope, but when the contents increase beyond a certain limit the cell must burst, so that spherocytosis is a stage towards hæmolysis. Comparing the functional capacity of a hæmoglobin-containing disc and a sphere of equal volume, he shows that the disc with almost double the surface area for oxygen exchange is far superior.



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**HANDBOOK OF ANÆSTHETICS (FORMERLY ROSS AND FAIRLIE).**—Revised by R. J. Minnitt, M.D. (L'pool), D.A. (R.C.P. & S., Eng.). Fifth Edition. 1940. E. and S. Livingstone, Edinburgh. Pp. xiv plus 364. Illustrated. Price, 12s. 6d. Postage, 7d.

THIS might have been described as a handbook of inhalation anaesthetics, for more than three-quarters of the book is devoted to this subject, except that the last two chapters, on local and spinal anaesthesia by Dr. W. Quarry Wood, justify the more comprehensive title.

It is not a new book, but after total revision by a new author it almost emerges as one. The style of the writer and the treatment of the subject is concise to the extent of being terse and is not a really pleasant book to read, but it delivers the goods.

The first sixty pages are on general matters, the theory and physiology of anaesthesia, shock and anaesthesia, asphyxia, etc. Then the author gets down to work with the preparation of the patient, basal narcosis, and the various anaesthetics in common and less common (cyclopropane and vinyl ether) use. There is a chapter on oxygen, helium and CO<sub>2</sub> administration; this is a little disappointing for whilst there are details of the manufacture of oxygen—very interesting but with little practical bearing on the subject of the book—there are no details regarding administration, beyond a description of the apparatuses in general use, and the short paragraph on helium leaves the reviewer exactly where he was as regards his knowledge of the use of this gas, which he would have thought was almost at zero.

However, it is a practical little handbook which will be of great value to the student of anaesthetics.

**DISEASES OF THE NERVOUS SYSTEM: DESCRIBED FOR PRACTITIONERS AND STUDENTS.**—By F. M. R. Walshe, O.B.E., M.D., D.Sc., F.R.C.P. 1940. E. and S. Livingstone, Edinburgh. Pp. xiii plus 288. Illustrated. Price, 12s. 6d. Postage, 7d.

PROFESSOR WALSH is a well-known English authority on neurology. All students of medicine are familiar with his name for his contributions in the two popular textbooks—Price and Conybeare. His free Wednesday lecture-demonstrations at the Queen Square are always crowded with post-graduates; the reviewer had lately the fortune of being one of the crowd.

Books on diseases of the nervous system are many, but most writings are complicated with redundant terms and methods of investigations that are best interpreted by the specialist. General students and practitioners need not grapple with them all, but it is difficult for them to undertake the task of selection, of emphasis, and specially of omission. Dr. Walshe has now produced the ideal book, lucid and easy to read. Common diseases of the nervous system have been dealt with in a simple way with special reference to diagnostic methods and treatment, avoiding complexities, such as descriptions of hypothetical views, synonymous signs and syndromes, ventriculograms, electro-encephalograms, etc.

The book is planned in two sections; the first part deals with the principles of neurological diagnosis with summary descriptions of the characteristic symptom-complexes of diseases of the nervous system. In the second are given the accounts of the common diseases, the details depending on the relative importance of each in practice. Certain subjects, *viz*, Argyll Robertson pupil, muscular atrophies, etc., have been discussed very clearly. All the latest therapeutic measures have been mentioned and the author has given cautionary comments in appropriate places, *e.g.*, 'Recently the claim has been made that the administration of vitamin E (tocopherol acetate) in doses of 3 mgm. thrice daily rapidly checks the progress of motor neuron disease. . . . So far, this claim has not been confirmed

and should be accepted with the very greatest reserve. . . . Massage is no more than a placebo, while to stimulate the weakening and wasting muscles by electrical currents is obviously to whip a tired horse'.

This is a really good book and fulfils the needs of general practitioners and students.

R. C.

**THE COMPLETE PEDIATRICIAN: PRACTICAL, DIAGNOSTIC, THERAPEUTIC AND PREVENTIVE PEDIATRICS.**—By Wilburt C. Davison, M.A., D.Sc., M.D. Third Edition. 1940. Duke University Press, Durham, N.C. Pp. vi plus 256. Price, \$3.75 by cheque with order, or for \$4.00 on credit

WHAT French's 'Index of Differential Diagnosis' and Robert Hutchison's 'Index of Treatment' are to general medicine this book is to pediatrics. It brings all the good features of the above books into one volume, and adds many original features of its own. It is absolutely up to date, even containing references to sulphathiazole, a drug which has only arrived in India in commercial quantities within the past few weeks.

The reviewer happens to possess a copy of the first edition of this book published in 1926, then called 'Pediatric Notes'. The amount of knowledge contained in the two books may be aptly compared with that contained in an infant's brain and that in a full-grown adult's. The book has grown out of all recognition and its usefulness has increased a thousandfold.

It contains up-to-date details of laboratory tests, including those used for tropical diseases, bacteriological procedures, and culture media in common use. Diet tables and recipes for preparing foods, diabetic diets, chemical analysis of prepared foods and elimination diets for use in allergic conditions are all included. In fact, it is difficult to find any fact that one is likely to need that is not included in this amazing book.

When using the index, the American spelling is sometimes a little delaying to one accustomed to English spelling. To quote one example, one looked for 'amœbic dysentery' and found it spelt 'amebic'. Another point where American practice deviates from the British is in their weights and measures, and a warning is necessary to those using the tables of equivalents in chapter XIII. In these tables, the author uses the abbreviation 'oz.' for the apothecaries ounce of 480 grains, whereas in British terminology the symbol ℥ is used, the abbreviation 'oz.' being restricted to the avoirdupois ounce of 437.5 grains. How one wishes the metric system was universally adopted to avoid all possibility of confusion and error! The metric system is used as standard in this book and the above applies only to the tables mentioned.

This review can give only a minute idea of the vast store of knowledge gathered together in this book. The best recommendation that the reviewer can give is to say that this book has found a permanent place on his desk for reference purposes.

J. F. C.

**THE NEWER NUTRITION IN PEDIATRIC PRACTICE.**—By I. Newton Kugelmass, B.S., M.A., M.D., Ph.D., Sc.D. 1940. J. B. Lippincott Company, Philadelphia and London. Pp. xi plus 1155, with 183 illustrations. Price, 55s.

DIET is of greatest importance in relation to the growth of a child. The biochemists have now provided us with vitamins from A to T and with knowledge of various forms of metabolism, and have demonstrated the important part they play in various diseases. Unfortunately, there is scarcity of books that correlate all the recent facts from the biochemical laboratory with clinical medicine and applied therapeutics. Consequently this newer form of medical investigation and management is apt to be neglected.

Dr. Kugelmass has brought out this book to apply the newer knowledge of nutrition derived from modern experimental science to everyday practice of pediatrics. It is divided into three main sections: the first part, devoted to nutritional physiology, deals with various



subjects such as basis of growth, food energy, calorie requirement, vitamins, digestion, absorption, metabolic processes, etc. The second section deals with nutrition in health, and presents established principles and procedures for the advancement of health and the prevention of disease. Infant feeding, infant formulas and child nutrition have been thoroughly discussed in this connection. The last section deals with most of the disorders of infancy and childhood in terms of nutrient causation. Systemic disturbances primarily affected by nutritional factors and regional diseases secondarily related to diet have also been dealt with in this section.

There are numerous tables, charts and illustrations. The dietary management of disease has been exemplified by calculated English diets for different age groups. Selected references have been given at the end of each chapter.

The book provides a mine of information and no pediatrician can afford to be without it.

R. C.

**SURGERY OF THE HAND.**—By R. M. Handfield-Jones, M.C., M.S., F.R.C.S. 1940. E. and S. Livingstone, Edinburgh. Pp. viii plus 140, with 95 illustrations including several in colour. Price, 15s. Postage, 6d.

WITH the increasing participation of this country in the war and the expansion of industry, surgical conditions of the hand are bound to become commoner. In the opening chapters of this book we read that of the injuries sustained by employees in Great Britain's heavy industries over 60 per cent are hand injuries. The author quotes some impressive figures to show how both worker and industry benefit from proper medical control. An outline is given of methods that are proving successful in Great Britain, and they are adaptable with little modification to conditions in India.

The first half of the book is taken up with the infections of the hand and the restoration of function. The modern approach to these problems is explained in a straightforward manner, and many old misconceptions and incorrect methods of treatment receive their *coup de grâce*. Movement of affected fingers from a very early stage is given as the secret of a good final result. The sling and the finger-stall are regarded as menaces, and manipulation of stiff fingers is not advised except in special circumstances.

In the second section, injuries of the hand are dealt with, beginning with fractures. In discussing the question of tendon suture, differentiation is made between the treatment of free and ensheathed tendons. Adhesions or sepsis will surely follow if suture of ensheathed tendons is not postponed until all signs of inflammation have disappeared. Primary suture of free tendons is worth attempting if the wound is clean and has received attention within eight hours.

A test for latent sepsis is given for employment before secondary suture is undertaken.

The last section describes congenital and acquired defects, and tumours of the hand.

The text, clarified by illustrations rather than by case notes and experimental work, occupies no more than 134 pages. But it has been most carefully prepared and beautifully published. It should have a wide appeal, but it is specially recommended to casualty surgeons and medical officers of industrial concerns.

W. McN. N.

**ILLUSTRATIVE ELECTROCARDIOGRAPHY.**—By Julius Burstein, A.B., M.D. Originally written by the Late J. H. Bainton, A.B., M.D., and J. Burstein, A.B., M.D. Second Edition. 1940. D. Appleton-Century Company, Incorporated, New York, and London. Pp. xviii plus 292, with 106 plates. Price, 25s.

THE first edition of this well-known book on electrocardiography was reviewed in this journal in the July issue in 1935. In this, the second edition, the book

has been brought up to date by the inclusion of newer developments in the subject of electrocardiography. Recent developments in electrocardiographic diagnosis of coronary occlusion and myocardial disease, and an exhaustive description of the subject of precordial leads are the chief additions. Inclusion of the electrocardiographic changes in acute cor pulmonale, in chronic right ventricular strain, P-wave change in left auricular stress, and a more detailed description of chronic left ventricular strain, would have further enhanced the value of this book.

The reviewer feels that this edition will maintain the popularity that it gained by its simple descriptive style and the excellence of its illustrations.

P. C. S. G.

**ESSAYS ON CARDIOLOGY.**—By Dr. Jal Gopal. Published by the 'Indian Medical Journal', 131, Coral Merchant Street, Madras. Pp. 192. Illustrated. Price, Re. 1

'THIS volume presents seventeen essays on some of the more important aspects of cardiology, and although the author makes no claim for erudition or completeness, yet they are so presented as would evoke the interest of the general practitioner' in the subject. The essays were published in the columns of the *Indian Medical Journal*, the journal of All-India Licentiates' Association and the book is the compilation of these essays in a single volume.

The publishers cannot be congratulated on the get-up of this book. With slightly increased cost, they might have prevented this book from being a number of reprints stitched together and indifferently bound.

L. G. G.

**PATHOLOGICAL HISTOLOGY.**—By Robertson F. Ogilvie, M.D., F.R.C.P. (Edin.). E. and S. Livingstone, Edinburgh. Pp. x plus 332, with 220 photomicrographs in colour. Price, 27s. 8d. Obtainable from Messrs. Butterworth and Company (India), Limited, Bombay and Calcutta. Price, Rs. 18-8-0

WHEN one says that the outstanding feature is the illustrations, it is not a criticism of the part the author has played in the production of this excellent book; in fact we believe that he would be the first to agree that Mr. P. C. Dodds' photomicrographs and their reproduction by Graphic Art Limited of London have made his book.

There are over two hundred really remarkable reproductions of coloured photographs of pathological sections, with concise but adequate descriptions below them, which really do show what they are meant to show, and simplify the interpretation of the sections issued to students in such a way as to make the reviewer almost wish that he had been born thirty years later.

The arrangement of the book is orthodox, and very satisfactory; the first chapters are on disturbances of nutrition, disturbances of circulation, inflammation and repair, septic inflammations, and tumours. Then the special systems are dealt with, each in a separate chapter.

The reviewer obtained some satisfaction from the fact that in a book with such a high standard of illustration the reproductions of the photographs of individual blood cells were not any clearer than those illustrating his own paper that appeared in this journal last month, and about which he was very disappointed at the time.

The chapter on the hæmopoietic system is a very good one and the origin of the various cell types seen in the peripheral blood in health and disease is clearly described. The author follows the usual British system in making the megakaryoblast only an embryonic and pathological cell; he describes the primary erythroblast as arising directly from the common stem cell, the hæmocytoblast from which myeloblasts, monoblasts and lymphoblasts also arise. Whilst acknowledging that this is the usual teaching in Great Britain, we believe that there is a non-hæmoglobinized cell more primitive

than the author's primary erythroblast (whose nucleus according to his description has no nucleoli), but which is nevertheless a differentiated cell of the red-cell series; this cell is the 'megaloblast' of the Sabin school.

It is a book that no teacher of pathological histology should be without and to the student who can afford to buy a copy we strongly recommend it as very good value indeed for the money.

**ELEMENTARY ATLAS OF HISTOLOGY.**—By **Burton Bradley, M.B., Ch.M. (Syd.), M.R.C.S. (Eng.), L.R.C.P., D.P.H. 1940.** Angus and Robertson Limited, Sydney. Pp. x plus 122. Price, 15s.

THE author is an experienced teacher of long standing and naturally he has studied the difficulties of the students. He has very correctly pointed out that the students in their practical class work have got to take a 'great deal' as granted because their specimens in the class are not always fully representative ones. So it is good for them to get some typical pictures which can be readily consulted on the working bench. For those who have just started to visualize the complications of the animal structures, it is necessary that they must have a picture in front of them to let them understand what they are expected to see under the microscope. Bigger volumes are often discouraging to the students because of their size and are often apt to be left at home. The present atlas is very handy and contains most of the pictures required by a medical student. From the above points of view this small atlas of histology will be of help to the students.

B. P. T.

**ELEMENTARY PATHOLOGICAL HISTOLOGY.**—By **W. G. Barnard, F.R.C.P. Second Edition. 1940.** H. K. Lewis and Company, Limited, London. Pp. x plus 75, with 181 illustrations (including 8 in colour) on 54 plates. Price, 10s.

FROM the students' point of view, very few branches of medical science require the help of photographs, diagrams, illustrations, etc., as much as the subject of morbid histology. Hence I welcome the second edition

of Barnard's small handbook on pathological histology. It will help immensely the students on the working bench and reading table as a ready reference. Of course, the students should be warned that this small volume cannot in any way be allowed to replace a textbook on the subject and it must not be forgotten, as rightly pointed out by the author, that it is an elementary one. The chosen size of the pictures is very happy because they enable the students to visualize the changes that have occurred in a wider area. Inclusion of more high-power pictures would have been very helpful. Some of the lower-power pictures, as for instance the figures 36, 37 and 49, do not convey much idea to the students for want of detail. Combination of low-power and high-power pictures, as adopted in figures 23 and 24, should have been more followed. It is doubtful whether inclusion of a few sporadic atypical pictures, such as atypical squamous cells carcinoma (figures 130 and 131) and the Wilms tumour (figure 145), is necessary in a handbook which is very elementary in nature. In the tumour section the nerve tissue tumours and group of teratomatous tumours are missed.

However, considering the vastness of the subject, a book of this size which is nevertheless comprehensive will be much appreciated. The author should be congratulated, especially for his preface to the first edition which is true in every way.

B. P. T.

**NEUROSYPHILIS (SYPHILIS OF THE NERVOUS SYSTEM).**—By **C. Worster-Drought, M.A., M.D. (Cantab.), F.R.C.P. (Lond.). 1940.** John Bale, Sons and Staples, Limited, London. Pp. xiv plus 241. Illustrated. Price, 10s. 6d.

THIS monograph is a valuable addition to syphilology. References are plentiful and so are the author's personal observations. Lucid accounts have been given of Spatz's test, fixed pupil, myotonic pupil with areflexia, and the significance of Wassermann's and Lange's reactions. Illustrations are excellent. Skiagrams showing tabetic arthropathies compatible with a patient's usual life are specially informative.

The format is good and price reasonable.

## Correspondence

### A CASE OF YAWS

SIR,—I enclose herewith four photographs of a case of yaws from the Kamrup district of Assam where this disease is endemic.

The photographs are so exceptionally clear, and the eruption so unusually developed that I thought you might wish to reproduce them in the *Indian Medical Gazette*.

No. 1 photograph shows the distribution of the eruption on the anterior surface of the body.

No. 2 shows the distribution on the posterior surface.

No. 3 shows a detailed view of the eruption on the head and shoulders.

No. 4 shows the same patient after treatment with a course of N.A.B. totalling 4.95 grams. Apart from the complete disappearance of the eruption, the improvement in the general condition of the patient is very noticeable.

The photographs were taken for me by the Sen Studios, Gauhati, Assam.

E. S. PHIPSON, C.I.E., D.S.O., M.D., F.R.C.P.,  
COLONEL, I.M.S.

### A CHEAP FLUSH-OUT LATRINE

SIR,—May I trespass on your space in one matter? On page 677 of your November issue, you have a short article on a flush-out type of latrine. My experience here with septic tanks and bore-holes is that the

type Dr. Rangaswami has described is by far the best. So much so, that we have had a number in use here now for close on six years with absolutely no trouble of any sort during that period. The septic tank type we have again and again had trouble over. Also the open type bore-hole which in some cases has caved in during the rainy season and has often attracted flies, mosquitoes, etc. With the covered large bore-hole type outside, connected to a flush closet inside there is simply nothing to go wrong.

A 14-inch bore-hole auger, bought in Calcutta for Rs. 82, had its cutting edge worn off in our hard soil making three holes. A hole 7 feet by 20 feet can be dug by four men at a cost of Rs. 5, bricked by 10-inch bricks, covered, and connected to an inside squatting pan, with a small 5-inch or 3-inch brick reservoir for water at its side; it will require no attention for years.

E. B. SHARPE,  
Superintendent.

PURULIA LEPER HOME AND  
HOSPITAL,  
PURULIA, B. N. R.,  
BIHAR.

### INDIAN HOSPITAL UNIT IN LONDON

SIR,—London, the Mecca of Medicine, is menaced, and as the hospitals have suffered considerably may I suggest that India should show her gratitude to British

A CASE OF YAWS: COLONEL E. S. PHIPSON



No. 1.



No. 2.



No. 3.



No. 4.



hospitals by financing an entire emergency hospital unit in London for the treatment of civilian patients. By affording facilities for teaching students and post-graduates from India, such a unit would form the nucleus (let us hope) of a permanent hospital in the near future. Those subscribing to the various funds may ear-mark part of their contributions to an Indian hospital unit.

M. N. PAI, M.B., B.S., M.R.C.P., D.C.H.,  
D.P.H., D.T.M., D.P.M.

## Service Notes

### APPOINTMENTS AND TRANSFERS

THE VICEROY AND GOVERNOR-GENERAL has been pleased to make the following appointment on His Excellency's personal staff:—

#### *To be Honorary Surgeon*

Colonel H. J. M. Cursetjee, D.S.O., vice Colonel D. F. Murphy, M.C., vacated 8th November, 1940.

On return from leave Lieutenant-Colonel H. M. Salamatullah is reverted to military service.

Lieutenant-Colonel W. Aitchison, Civil Surgeon, on return from leave is posted as Civil Surgeon, Allahabad.

Lieutenant-Colonel A. H. Shaikh, Superintendent, Central Prisons, Bareilly, is appointed as Inspector-General of Prisons, United Provinces, with effect from the 1st October, 1940.

Lieutenant-Colonel J. P. Huban, O.B.E., Administrative Medical Officer in Rajputana, is appointed to officiate as Additional Deputy Director-General, Indian Medical Service, with effect from the 4th December, 1940, vice Lieutenant-Colonel R. F. D. MacGregor, C.I.E., M.C., granted leave.

Major E. S. S. Lucas, Civil Surgeon, is transferred from Allahabad to Dehra Dun.

The services of Major W. J. Moody, an Agency Surgeon, are temporarily placed at the disposal of His Excellency the Commander-in-Chief, with effect from the 4th December, 1940.

Major S. C. H. Worseldine, Civil Surgeon, Dehra Dun, reverted to military service, with effect from the 9th December, 1940.

On return from leave Major G. F. Taylor resumed charge of the office of Professor of Clinical Medicine, K. E. Medical College, Lahore, on the forenoon of the 16th December, 1940.

On recall to military duty Major P. C. Dutta, Civil Surgeon, Ferozepur, made over charge of his civil medical duties, on the forenoon of the 16th December, 1940.

Major G. B. W. Fisher, Resident Medical Officer, Eden Hospital, Calcutta, is appointed to be 1st Resident Medical Officer, Presidency General Hospital, Calcutta, vice Captain W. M. Niblock.

Major W. McAdam, Civil Surgeon, Taunggyi, on transfer, made over and Major A. E. Kingston received charge of the duties of Civil Surgeon, Taunggyi, Southern Shan States, on the afternoon of the 27th December, 1940.

The services of Captain J. W. D. Goodall, 2nd Resident Medical Officer, Presidency General Hospital, Calcutta, are placed at the disposal of the Government of India in the Defence Department.

Captain W. M. Niblock, 1st Resident Medical Officer, Presidency General Hospital, Calcutta, is appointed to be 2nd Resident Medical Officer of the same institution, vice Captain J. W. D. Goodall reverted to military duty.

### INDIAN LAND FORCES

(Permanent Commission)

#### *To be Captains (on probation)*

Konnanath Siva Rama Menon. Dated 13th December, 1940, with seniority from 13th December, 1936.

Indar Singh. Dated 27th December, 1940, with seniority from 27th December, 1936.

### INDIAN LAND FORCES

(Emergency Commissions)

#### *To be Captain (on probation)*

Muthusami Nata Ranjan. Dated 15th October, 1940, with seniority from 15th October, 1932.

#### *To be Lieutenants (on probation)*

15th October, 1940

Ashutosh Bhattacharjee.  
Biman Bihari Sen Gupta.  
Kshiti Bhusan Sen.  
Dharani Kanta Ghosal.  
Harabrata Sen Gupta.  
Biraj Mohan Sinha.  
Sisir Kumar Ghose.  
Sudhindra Nath Sinha.  
Cheruvallil Kelan Kesavan.  
Chikkamaglore Sitaramiah Krishna Murthi.  
Sudhir Kumar Chowdhury.  
Kshirode Chandra Hazra.  
Murukutla Purushottama Sharma.  
Perumpattivadakkathil Cheryan Koshy.  
Sudhansu Kumar Ray.  
Govindan Sambasivan.  
Kattingere Kesav Nayak.  
Bishen Lall Raina.  
Pananghat Antony Paul.  
Vendantha Rangachari.  
Pannikot Balkrishna Menon.  
Ambarakhana Sita Lakshmi Narasimham.  
Samavedam Appan Raghava Iyengar.  
Maharagapuram Venketasubramonia Krishnamurti.  
Inala Rangabrahmananda Rao.  
Sylvester Rodrigues.  
Sudhir Chandra Roy.  
Somes Chandra Ghosh.  
Harish Chandra Mediratta.  
Rajupet Rajagopala Reddi.  
Sankara Menon Vasava Menon.  
Frederick Manuel Koland.  
Codati Bhadraraj.  
Muhammad Mofazzal Hossain.  
Vellore Ramalinga Mudaliar Sadasivan.  
Luke Verghese.  
Subrata Ghose.  
Somnath Mukerjee.  
Saligram Kaul.  
Mohammad Ramzan.  
Zinnur Ahmed Choudhuri.

16th October, 1940

Mohammad Abdul Majid Choudhry.  
Tayi Anjaneyulu.

1st November, 1940

Basant Lal Malhotra.  
Nootheti Chinna Venkata Raman.  
Ravilla Venkata Rama Rao.  
Sailadhan Banerjee.  
Divakar Shantaram Patkar.  
Marath Sankarankutti Menon.  
Pangal Krishna Nayak.  
Kolluru Madhusudana Rao.  
Matavil Balakrishnan Nair.  
John Panampunnayil Zachariah.  
Kavungal Bhaskaran.  
Bhupesh Chandra Karmaker.  
Kunnathur Parthasarathy.  
Niranjan Choudhury.  
Chandy Joseph.

Anantasubramania Iyer Lakshminarayanan.  
 Chetan Anand Sardana.  
 Pattapet Venkatramier Venkatachalam.  
 Kaddipudi Mariswamappa.  
 Venkatachalam Subramania Iyer.  
 Panikulam Kunjipaloo Antony.  
 Pritam Pal Singh.  
 Omkar Chandra Mathur.  
 Abdul Ghaffar Siddiqi.  
 Mohammad Ibrahim.  
 Anthony George Joseph Philip Fernandes.  
 Shamsheer Balwant Singh.  
 Mohammad Aslam.  
 Gour Mohan Das.  
 Daya Shankar Shukla.  
 Satya Prakash.  
 Kasturi Lal Gupta.  
 Khurshid Alam Malik.  
 Vyankatesh Lakshman Parnaik.  
 Krishna Lal Datta.

2nd November, 1940

Bijoy Mukerji.

#### PROMOTIONS

*Lieutenant-Colonel to be Colonel*

C. H. N. Baker, M.C. Dated 8th November, 1940,  
 with seniority 31st July, 1936.

*Major to be Lieutenant-Colonel*

W. Aitchison, M.C. Dated 20th December, 1940.

The seniority of the undermentioned Majors in their  
 present rank is antedated to the dates stated below:—

L. G. Backhurst. Dated 10th May, 1937.  
 D. C. Chopra. Dated 19th May, 1937.  
 J. Singh. Dated 19th May, 1937.  
 E. A. R. Ardesheer. Dated 16th June, 1937.  
 H. S. Waters. Dated 4th August, 1937.  
 J. H. Boulton. Dated 29th October, 1937.  
 J. P. J. Little. Dated 30th October, 1937.  
 E. A. O'Connor. Dated 30th October, 1937.  
 P. L. O'Neill. Dated 30th October, 1937.  
 G. R. M. Apsey. Dated 22nd November, 1937.  
 B. Temple-Raston. Dated 22nd December, 1937.  
 V. E. M. Lee. Dated 1st February, 1938.  
 G. B. W. Fisher. Dated 2nd February, 1938.  
 E. P. N. M. Early. Dated 6th February, 1938.  
 D. Tennant. Dated 1st March, 1938.  
 D. P. Mitra. Dated 1st March, 1938.  
 T. D. Ahmad. Dated 6th April, 1938.  
 M. Jafar. Dated 9th April, 1938.  
 B. N. Khan. Dated 2nd May, 1938.  
 A. M. Chaudhuri. Dated 6th May, 1938.  
 W. Happer. Dated 2nd August, 1938.  
 H. J. Curran. Dated 4th August, 1938.  
 W. P. Lappin. Dated 4th August, 1938.  
 B. J. Griffiths. Dated 4th August, 1938.  
 J. H. Gorman. Dated 4th August, 1938.  
 M. H. Shah. Dated 10th August, 1938.  
 R. T. Hicks. Dated 22nd October, 1938.  
 A. M. Sheridan. Dated 29th October, 1938.  
 P. V. Bamford (since deceased). Dated 15th January,  
 1939.  
 K. Jilani. Dated 26th January, 1939.  
 D. H. Waldron. Dated 6th February, 1939.  
 C. H. Dhala. Dated 8th February, 1939.  
 S. Narain. Dated 25th February, 1939.  
 D. Datt. Dated 10th April, 1939.  
 B. L. Taneja. Dated 19th May, 1939.  
 W. J. Moody. Dated 6th June, 1939.  
 S. W. H. Askari. Dated 3rd July, 1939.  
 A. B. Guild. Dated 4th August, 1939.  
 Captain Fateh Mohammad Khan, Health Officer,  
 Simla, has been promoted to the rank of Major, with  
 effect from the 3rd April, 1940.

#### RETIREMENT

Lieutenant-Colonel N. C. Kapur. Dated 21st October,  
 1940.

## Notes

### DAGENAN—M. & B. 693

#### REDUCTION IN PRICE

We are informed by the makers of DAGENAN—  
 M. & B. 693, Pharmaceutical Specialities (May and  
 Baker), Limited, Dagenham, that a reduction in the  
 price of this drug has now become effective. The new  
 prices, which are subject to the usual medical discount,  
 are as follows:—

	Rs.
<i>Dagenan—M. &amp; B. 693</i>	
Containers of 25 × 0.50 gm. tablets ..	4-12
" " 100 × 0.50 " " ..	18-7
" " 25 × 0.125 " " ..	2-11
Boxes of 6 × 2.50 c.cm. ampoules 20 per cent oily suspension ..	4-4
<i>Dagenan sodium—M. &amp; B. 693 soluble</i>	
Boxes of 6 × 3 c.cm. ampoules 33½ per cent solution ..	7-5
Boxes of 25 × 3 c.cm. ampoules 33½ per cent solution ..	28-0

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## Original Articles

PNEUMOCOCCAL PERITONITIS : WITH  
REPORT OF A RECOVERY WITH  
M. & B. 693

By W. B. ROANTREE, M.A., M.D. (Dub.), F.R.C.S. (Ed.)  
Chief Medical Officer, Kolar Gold Fields Hospital  
and

A. CAPLAN, M.D. (Lond.), M.R.C.P. (Lond.)  
Senior Medical Officer at the Hospital

THE comparative rarity of pneumococcal peritonitis, its high mortality, its peculiar problems of diagnosis, and differences of opinion as to the place of surgery in its treatment, combine to make it a disease of unusual interest. In this article an abstract of the literature of pneumococcal peritonitis is given and a report is included of an early case which was treated with remarkable success by M. & B. 693 after operation. The rapidity with which symptoms disappeared with this treatment is considered to justify the publication of a single case of an uncommon disease which in the past has been very fatal.

**Incidence.**—The rarity of pneumococcal peritonitis is illustrated by the relatively few cases seen by individual surgeons. Barrington-Ward (1932) has personally observed 20 cases over a period of 15 years. Newell (1939) records 36 cases admitted to the Harriet Lane Home for children in 25 years.

**Sex incidence.**—The great preponderance of the female sex in cases of primary pneumococcal peritonitis is well known. McCartney and Fraser (1922) record 56 cases all of which were females. Newell (*loc. cit.*) however states that there is no significant difference in incidence between the sexes, and in his series of 12 cases of this form of the disease 7 were females and 5 were males; but this experience is counter to that of most writers, who attach diagnostic importance to the sex. In the secondary form either sex may be affected.

**Age incidence.**—The limits commonly recognized are between 1 and 10 years with a maximum incidence of 3 to 7 years; very occasionally adults are affected.

**Mortality.**—The high mortality of pneumococcal peritonitis is a constant characteristic of acute cases described in the literature; the figures become considerably lower in the late stages of the disease when their interpretation is obscured by the question of survival ratio. As an illustration of the mortality of the diffuse form of pneumococcal peritonitis, Carson (1924) quotes one series of 46 cases with 86 per cent mortality, and another of 45 cases with 100 per cent mortality. Loutsch and Mériqot (1934) describe 10 cases with a mortality of 40 per cent.

Lipshutz and Lowenburg (1926) report 23 cases of pneumococcal peritonitis and streptococcal peritonitis in children under 6 years of age, each with a mortality of 100 per cent. Newell (*loc. cit.*) states that in the literature the mortality of pneumococcal peritonitis averages from 40 per cent to 65 per cent and the 36 cases of pneumococcal peritonitis which he reports had a mortality of 61.1 per cent.

**Pathogenesis.**—The usual classification of the disease is into primary, or idiopathic, and secondary. In the secondary form the focus of origin is known, whereas in the primary the evidence on this point is conflicting.

The portals of infection may be :—

- (i) the female genital tract,
- (ii) upper and lower respiratory tracts, including the middle ear,
- (iii) the intestinal tract.

The pneumococci reach the peritoneal cavity either by local spread, *e.g.*, from the female genitalia (as in the case described in this paper) or the bowel, or by the blood-stream as part of a septicæmia, the peritonitis in the latter event being a local manifestation of a general disease. Newell (*loc. cit.*) and Lazarus (1932) draw attention to a group in which nephrosis is the predisposing cause.

**Pathological appearances.**—The pathological picture varies with the stage of the disease. The earliest appearances in cases of primary pneumococcal peritonitis are those of pelvic peritonitis with salpingitis; the visceral and parietal peritoneum of the pelvis and lower ileum are intensely congested and a small amount of free fluid may be found. The fallopian tubes are acutely inflamed and œdematous, patches of purulent exudate adhere to them, and pus may be expressed from the fimbriæ. The pneumococcus in pure culture can be obtained from both exudate and tubes. It is noteworthy that type I pneumococcus has been recovered in the vast majority of cases of primary pneumococcal peritonitis. After 24 hours the peritonitis tends to spread and the exudate becomes purulent after the fourth day. In the secondary form of the disease the peritonitis is generalized from the outset. From about the fourth to the twelfth day the general peritoneal exudate is purulent, greenish in colour, and contains flakes of fibrin. If this stage is survived localization usually follows and the late stage of encysted abscess supervenes. Such abscesses are commonly situated in the pelvis and may be loculated; if untreated they tend to discharge spontaneously through the umbilicus.

**Clinical manifestations.**—Clinical manifestations will depend upon the virulence of the infection. In the acute and commoner form of pneumococcal peritonitis the disease may progress to a rapidly fatal issue, whereas in the subacute form the onset may be insidious and localization of the peritonitis with abscess



formation is more likely to occur. The characteristic symptoms are: acute abdominal pain, vomiting, diarrhoea, pyrexia, and occasionally dysuria and tenesmus; the onset may be succeeded by a temporary improvement. Abdominal pain is a prominent complaint and may be peri-umbilical, sub-umbilical, or referred to either iliac fossa; the pain may be intermittent, especially in subacute cases. The frequency of diarrhoea is emphasized by many authors.

On examination the patient is found to be acutely ill, drowsy or perhaps even delirious, with an anxious facies and a tinge of cyanosis. Pyrexia is usually well marked, temperature 102°F. to 104°F., but it is important to note that sometimes it may be mild or even absent. Respiration and pulse rates are rapid. The abdomen which may be distended is found to exhibit limitation of movement on respiration. Tenderness and rigidity may both be present in the lower abdomen including the iliac fossæ, and will be noticeably indefinite. The contrast between the somewhat indefinite local abdominal findings and the severe general toxæmia is a feature of the condition. Leucocytosis is high, 20,000 to 40,000 cells per c.mm., with a high proportion of polymorphonuclear cells. Late stages of the disease are characterized by remittent pyrexia, wasting, abdominal distension, perhaps with local collections of pus in the lower abdomen, and marked absence of abdominal rigidity; an abscess may be pointing at the umbilicus.

*Differential diagnosis.*—The difficulties of diagnosis are so great that in the majority of cases a pre-operative diagnosis has not been made. Signs suggestive of peritonitis in a young female child, especially if accompanied by marked pyrexia, diarrhoea and a high polymorphonuclear leucocytosis, should always raise the suspicion of pneumococcal peritonitis in the examiner's mind and this may lead to confirmation of the diagnosis by peritoneal puncture, thus obviating the unnecessary hazard of a major operation. Positive findings provided by peritoneal puncture are the only certain means of making the diagnosis without operation. In this procedure a spinal needle is introduced into the peritoneal cavity with the object of obtaining at least a few drops of fluid for examination. The puncture may be made internal to the left anterior superior iliac spine with the child on its back, or as suggested by Duncan (1931) in the mid-line midway between the umbilicus and symphysis pubis with the child in the prone position. An alternative point of entry recommended by Loewe (1932) is through the posterior vaginal fornix. Bacteriological examination of the vagina is recommended by Kirchhoff (1930), and if this is positive for pneumococci it may be of assistance in the diagnosis.

In approaching the problem of diagnosis it must first be decided whether the patient is

suffering from peritonitis or not. Lobar pneumonia with peritonism may simulate peritonitis very closely; physical signs in the chest may be absent or misleading; rapid respiration, cyanosis, high pyrexia and leucocytosis may be present in both conditions. The indefinite rigidity in primary pneumococcal peritonitis may further confuse the diagnosis. It has also to be borne in mind that secondary pneumococcal peritonitis may arise as a complication of lobar pneumonia. Therapeutically the immediate differentiation is unimportant, M. & B. 693 being indicated in both conditions.

In this country abdominal pain and diarrhoea with moderate or high pyrexia are frequent symptoms of dysentery, and may be suggestive of enteric, both relatively very common diseases. Dysentery can readily be excluded by examination of the abdomen and fæces, and pneumococcal peritonitis can immediately be distinguished from enteric by the leucocyte count. Confirmatory evidence of enteric will be furnished by blood-culture, agglutination tests, etc. In cases with an enteric perforation the clinical picture is dominated by collapse. In severe cases of pneumococcal peritonitis in which drowsiness is a prominent sign meningitis may have to be excluded by lumbar puncture.

When a diagnosis of peritonitis has been made it is necessary to determine its ætiology owing to the urgent necessity for surgical treatment in cases in which it is secondary to appendicitis. When local abdominal signs are inconclusive, the following points may be helpful in establishing the diagnosis. Appendicitis is the commonest cause of peritonitis in children and the sexes are affected equally. High pyrexia and leucocytosis are more usual in pneumococcal peritonitis than in appendicular peritonitis, and whilst diarrhoea may occur in pelvic peritonitis secondary to appendicitis, it is more characteristically a symptom of pneumococcal peritonitis. In cases of doubt peritoneal puncture should be performed, and unless positive findings are obtained exploratory laparotomy is indicated.

In primary streptococcal peritonitis symptoms and signs may be indistinguishable from pneumococcal peritonitis. The condition is very uncommon, occurs mainly in the first year of life, attacks both sexes equally, and a positive diagnosis can be made by peritoneal puncture. The differentiation is to some extent academic, for both conditions may be successfully treated in the early stages by M. & B. 693.

The later stages of pneumococcal peritonitis may be difficult to distinguish clinically from the more acute forms of tuberculous peritonitis.

*Treatment.*—Prior to the introduction of M. & B. 693 in the treatment of pneumococcal peritonitis, controversy centred on the advisability or otherwise of immediate operation in early cases. Fraser was the chief supporter of conservative treatment provided that the diagnosis was certain. All authorities were agreed on the value of specific serum therapy at this

stage, and on the need for surgical treatment when localization of the infective process had occurred.

**Chemotherapy.**—Many reports have already appeared in the literature on the value of M. & B. 693 in the treatment of pneumococcal peritonitis (Gaisford, 1940; Maughan, 1940; Banks and Joseph, 1940) and evidence is accumulating that the place of M. & B. 693 in the treatment of this condition is clearly established. In the earliest stages when the infection is localized to the pelvis or before the general peritoneal exudate has become frankly purulent, surgery is contraindicated and the exhibition of M. & B. 693 in sufficient dosage should lead to complete resolution. Even when diffuse peritonitis with suppuration is present surgery should be withheld—provided the diagnosis is certain—and M. & B. 693 will be of value in combating the coincident septicæmia and assisting in the localization of the disease. Clinical experience in the treatment of severe pneumococcal diseases, especially those associated with a high mortality rate, such as meningitis and peritonitis, has shown that massive initial dosage is essential. The exact dose to be administered and the route and spacing of doses will depend almost entirely on the severity of the disease and the degree of toxæmia. Due regard must be given to the age of the patient, although it is a notorious fact that the relative dose for a child is weight for weight proportionately greater than for an adult. The degree to which children may tolerate massive doses of M. & B. 693 is well illustrated in a case described by Falla (1940) of pneumococcal meningitis in a child of seven successfully treated with this drug. Intramuscular M. & B. 693 soluble was given in doses of 1 gramme hourly during the first 24 hours, and repeated in this dosage during the third day of treatment, a total of 48 grammes being given in 5 days. It is generally agreed that fulminating cases of pneumococcal infections should receive the initial doses of M. & B. 693 parenterally, the intramuscular route being most convenient in a child. Banks *et al.* (1940) strongly advocate intravenous administration (3 c.cm. M. & B. 693 soluble to 9 c.cm. of saline), and emphasizes the dangers of muscle necrosis in intramuscular therapy. One of us (A. C.) has recently treated a number of cases of lobar pneumonia with repeated doses of M. & B. 693 soluble intramuscularly, and has never seen muscle necrosis nor severe pain follow. The value of parenteral administration, especially in young children, is self-evident; the possibility of defective absorption is excluded, the exact quantity of the drug absorbed is known, and therapeutic action is more rapid. Dosage may be regulated by estimating the blood concentration of M. & B. 693, about 10 mgm. per cent being desirable, although Flippin *et al.* (1939) found in pneumonia patients that the therapeutic action appeared to be as good in patients

with low concentrations as in those with high concentrations.

The following suggestions are made for the administration of M. & B. 693 in the treatment of pneumococcal peritonitis. The doses given are for children over 5 years of age; in children under 5 the doses should be halved.

**Initial dosage.**—One to 2 grammes at 2 to 4 hourly intervals depending on the severity of the disease. In fulminating cases the drug should be given intramuscularly or intravenously. In all cases it is desirable to give the first 2 or 3 doses during the first 24 hours parenterally until improvement in the general condition permits oral administration. 'Loading' the first and second doses by an additional half gramme may be found necessary in certain cases. The drug may be continued in this dosage for 24 to 72 hours depending on the response to treatment.

**Maintenance dosage.**—When a response is apparent the dose may be reduced to 0.25- to 0.5 gramme 4-hourly and continued for 48 hours after the patient has become afebrile, provided toxæmia is absent. Occasionally a relapse may occur after an initial response, and reversion to the initial massive doses may become necessary. The course of treatment need rarely extend beyond 6 or 7 days. The total amount given will obviously depend on the severity of the disease and the duration of treatment. The case described in this paper needed comparatively small doses over a short period, 4.75 grammes being given over a period of 72 hours. Severe cases in older children, however, may require 30 to 50 grammes during 6 or 7 days of treatment.

**Serotherapy.**—The value of serum therapy as an adjuvant to M. & B. 693 in the treatment of pneumococcal infections has yet to be determined. Anti-pneumococcal serum is costly, and except in gravely ill patients should rarely be necessary if adequate doses of M. & B. 693 are given. The commonest organism found in primary pneumococcal peritonitis is type I pneumococcus, and for this reason type I serum should be given until the pneumococcus isolated has been typed. Newell (*loc. cit.*) suggests that rabbit serum may be more efficacious than horse serum, basing this statement on experimental work done by Horsfall *et al.* (1937) in cases of pneumococcal empyema. These workers found that rabbit serum antibodies diffused more readily into pleural exudates than horse serum. Doses as large as 300,000 units daily have been given intravenously.

**Surgical treatment.**—The difficulty of making a certain diagnosis of pneumococcal peritonitis has already been alluded to, and surgical treatment in the early stages of the disease is restricted to cases in which the diagnosis remains in doubt. As by far the most important condition to be excluded by laparotomy is peritonitis arising from the appendix, a simple muscle-splitting incision in the right iliac fossa

is preferable to a paramedian incision, although in cases where the patient is not gravely ill the latter may be justified. A gridiron incision permits of appendicectomy and drainage through a counter incision in appendicular cases; and sufficient access to explore the pelvis and make a bacteriological examination with the minimum of disturbance in other cases. All are agreed on the necessity for conservative surgery in later stages of the disease, and when the pus has become localized simple drainage is required. The post-operative treatment is conducted on ordinary general surgical lines; special measures including small blood transfusion, and fluids intravenously, intramuscularly, or subcutaneously, should be given if required.

### *Case abstract*

A. P., a female Anglo-Indian child, aged 3 years and 5 months, was admitted into the Kolar Gold Fields Hospital on 9th October, 1940, complaining of abdominal pain and vomiting.

The child's previous history was unimportant. The present illness began at 11 p.m. the night before admission with abdominal pain referred to the lower abdomen; the pain persisted for about half an hour, recurred six hours later with increased severity and continued in this form for a further nine hours after which the child was brought to hospital. Vomiting occurred twice during the day; the bowels were not moved.

On examination the child was mildly toxæmic, alert, and apprehensive of abdominal examination. The breathing was shallow and rapid; temperature 100°F., pulse 160, respiration 56. The abdomen, which was not distended, showed much restricted respiratory excursion in its lower part, and considerable generalized deep tenderness with indefinite maximal localization in the right umbilical region, and moderate lower abdominal rigidity, possibly more marked on the right than the left. Liver dullness was present. No abnormality was found in the chest; there was no otorrhœa; and the tympanic membranes were normal on both sides.

An enema produced a satisfactory result without alleviation of symptoms. The patient was put in Fowler's position and kept under observation. On the following morning toxæmia had increased; the temperature had risen to 101.5°F., the pulse being 148. The *alæ nasi* were in full use. On examination the abdomen moved less freely on respiration than on the previous day, tenderness had increased noticeably and was doubtfully maximal in the right iliac fossa. Rigidity had also increased especially in the lower abdomen and was most evident on the right side. Liver dullness appeared to have diminished. A catheter specimen of urine showed no abnormal constituents. Total leucocytes 34,000 per c.mm. Differential—polymorphonuclears 97 per cent; lymphocytes 3 per cent; large mononuclears 0 per cent; eosinophils 0 per cent. Peritonitis was diagnosed, and this was considered to be most probably of appendicular origin. Atropine gr. 1/150 was given and exploration under ether anaesthesia performed.

*Operation.*—Small low right paramedian incision; rectus drawn aside; no free peritoneal fluid found. The appendix was normal, and the lower ileal mesenteric glands were soft, enlarged and slightly congested. On examining the pelvis a very acute bilateral salpingitis was discovered; the tubes were much engorged and fibrinous plaques of pus were adherent to tubes and ovaries on both sides. A swab for bacteriological examination was taken from one of the purulent patches, and from this type I pneumococcus was subsequently recovered in pure culture. Appendicectomy was performed and the abdomen was closed with a small drain down to the pelvis. At the end of a brief

operation the patient appeared to have a high temperature, and some generalized twitchings suggestive of ether convulsions occurred in the face and limbs. The patient was sponged and the twitchings ceased. A vaginal smear was taken whilst the patient was still anaesthetized, and from this staphylococcus albus—probably a contaminant—was recovered. It is regrettable that a blood culture was not taken at the same time.

In addition to general measures, treatment with M. & B. 693 was started immediately. M. & B. 693 soluble 1.5 c.cm. (0.5 gramme) was given intramuscularly before the patient left the theatre, and this was repeated in four hours' time. M. & B. 693 one tablet (0.5 gramme) was given by mouth after a further period of four hours, and thereafter one-half tablet repeated four-hourly until the drug was stopped 72 hours after operation, the total dose administered then being 3 c.cm. (1 gramme) of M. & B. 693 soluble intramuscularly, and 7½ tablets (3.75 grammes) orally. A feature of the post-operative course was its smoothness and complete absence of any cause for anxiety. An improvement in the general condition was noted soon after the institution of treatment, the temperature fell permanently to normal within 6 hours and a fall in the pulse rate followed 24 hours later. A small amount of watery discharge was noted in the drainage tube when removed on the second day and no further discharge occurred; the wound healed satisfactorily with only slight superficial infection. The white blood cells repeated 3 days after the operation were 8,000 per c.mm. Polymorphonuclears 56 per cent; lymphocytes 40 per cent; large mononuclears 2 per cent; eosinophils 2 per cent.

The only post-operative complaint was transient suprapubic pain and tenderness noted on the 5th day. The patient was discharged 15 days after the operation in good health and free from symptoms. One month later she was seen in the out-patient department and was found to be in excellent health.

### *Summary and conclusions*

Pneumococcal peritonitis has been discussed in its ætiological, pathological and clinical aspects. Particular attention has been paid to the difficulties of diagnosis, and clinical manifestations and treatment have been considered in some detail.

An early case of primary pneumococcal peritonitis in a female child has been described in which certain clinical features were atypical, namely, absence of high pyrexia and diarrhœa. The earliest stages of pneumococcal peritonitis were demonstrated at laparotomy, and type I pneumococcus in pure culture was isolated from the tubal exudate suggesting that the portal of entry of the pneumococcus was the genital tract. It is interesting to note that type I pneumococcus appears to be the causal organism in most cases of primary pneumococcal peritonitis. Treatment with M. & B. 693 was remarkably successful, the temperature falling to 98.4°F. within six hours of the beginning of treatment and at no subsequent period was this reading exceeded. The disappearance of toxæmia and the rapidity of resolution were correspondingly gratifying. The immediate improvement in the condition of the patient was in sharp contrast to the protracted and frequently unfavourable course of pneumococcal peritonitis recorded in the past.

One of the greatest problems in pneumococcal peritonitis is the difficulty of making a certain pre-operative diagnosis, and it seems likely that

in the future, as in the past, the correct diagnosis will be made at operation in many cases. The possibility of pneumococcal peritonitis should arise in an examiner's mind when he is confronted with a case—especially if it is a young female child—showing a combination of abdominal pain and tenderness with indefinite rigidity, toxæmia, high temperature, diarrhoea, and high polymorphonuclear leucocytosis. The suspicion of a pneumococcal peritonitis should lead to peritoneal puncture, and if the diagnosis remains in doubt after this procedure, exploratory laparotomy through a small right muscle-splitting incision is indicated.

The literature on the treatment of pneumococcal infection with M. & B. 693 contains ample evidence of the brilliancy of the results obtained by the use of this drug. The rarity of pneumococcal peritonitis, however, has resulted in comparatively few cases of this disease treated with M. & B. 693 being reported up to the present time. Such cases as have been described are very encouraging and the assumption is justified that M. & B. 693 is bound to lower the mortality—perhaps dramatically—of this hitherto very fatal disease. It seems likely that in early cases of pneumococcal peritonitis timely and adequate administration of M. & B. 693 will lead to complete resolution and in later cases will permit the natural defences of the body to localize the disease. Attention has been drawn in this paper to the value of M. & B. 693 soluble during the initial stages of treatment.

At the early stages surgery is contraindicated, but in late cases with local collections of pus, surgical drainage is a necessity, and it is unlikely that M. & B. 693 will have any effect on such cases unless septicæmia is present.

The authors are well aware of the fallacy of basing conclusion on a single case, but the example described in this article is not an isolated report, and is presented as a link in a growing chain of evidence of the value of M. & B. 693 in the treatment of pneumococcal peritonitis.

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# PNEUMOCOCCAL PERITONITIS

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ALTHOUGH acute lobar pneumonia is a common malady, infection of the peritoneum is an uncommon occurrence. It is also very curious that both the pleural and the pia-arachnoid membranes are frequently involved in acute pneumococcal infection but the peritoneum is seldom found to be the site of disease. In the study of acute lobar pneumonia, peritonitis is always cited as a complication but in actual fact the latter condition is rarely seen either clinically or in the autopsy room. In very severe cases of lobar pneumonia, it is often found that the abdomen becomes enormously distended giving rise to some pain, tenderness, diarrhoea or constipation, and even obliteration of the liver dullness in front. Such a picture gives rise to a suspicion of involvement of the peritoneal sac, but this has not been corroborated on the autopsy table. The literature on the subject is very scanty, Barrington-Ward found only 20 cases in 15 years in the hospital for sick children at Great Ormond Street. Duncan has reported only 34 instances during the period of 10 years in the Children's Hospital at Toronto. Obadolek has observed 50 cases in 10 years in his clinic at Brunn. Indian statistics are notoriously scanty and the writers have not yet found any well-authenticated series published anywhere. Under such circumstances discussion of the subject with the illustration of a case may be of interest.

## Case report

N. S., 11½ years, Hindu male, was admitted into the Medical College Hospitals on 9th April, 1940, with the following complaints:—

Pain in the abdomen and gradual swelling for the last 25 days; dyspnoea for the last 7 days; swelling of the legs for the last 3 days.

*History of the present complaint.*—On the morning of 11th March, after taking his bath, the patient had a sudden rise of temperature accompanied by chill

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and rigor. The fever rose to 103°F, but it came down to 100°F. next morning. The temperature continued for 8 days but dropped to normal on the morning of the 9th day of the illness, although it rose again in the evening. An intermittent temperature continued till the date of his admission into the hospital on 9th April.

On 13th March the patient had passed several loose motions but on the next day he complained of constipation and pain in his abdomen. Also he did not pass any urine. On the 5th day of his illness he was given an enema after which his bowels became irregular and he suffered from alternate constipation and diarrhoea. He also noticed that his abdomen was gradually becoming distended. The patient became breathless for the last 7 days and he noticed swelling of the feet and legs 3 days prior to his admission into the hospital.

*Past history.*—The patient had suffered from osteomyelitis of the right tibia at the age of one year.

*Family history.*—The patient is the fourth issue of his parents. He has three brothers and three sisters all of whom are healthy. Before the onset of his illness, the patient was the healthiest of all.

*Physical examination.*—Marked emaciation, dyspnoea and anaemia; no jaundice; no glandular enlargement; abdomen markedly distended; oedema of legs and scrotum; tongue moist and coated; temperature 99.4°F.; pulse 104; respiration 42; dyspnoeic; cough present but not troublesome; marked diminution of movement on the right side. Vocal fremitus markedly impaired at the axillary, infra-axillary and infra-scapular areas on the right side and there was stony dullness over them. On auscultation, breath sounds were found to be absent over the above areas. On the left side, signs of consolidation were detected. Apical impulse was found in the left fourth intercostal space. The heart sounds were weak and a haemic murmur was heard over the mitral and pulmonary areas. The abdomen was distended. Fluid thrill and shifting dullness were present. There were a few prominent veins on the abdominal wall filling from below upwards. The liver and spleen could not be palpated due to distension. Urine was very scanty.

*Laboratory findings.*—Blood: Haemoglobin 50 per cent; red cells 2,650,000 per c.mm.; leucocytes 18,750 per c.mm.; polymorphonuclears 90 per cent; lymphocytes 8 per cent; monocytes 1 per cent; eosinophils 1 per cent. No malarial parasites found. Blood culture—negative. Agglutination test—negative to T.A.B.

Urine: Yellow colour. Specific gravity 1020. No albumin or sugar. Plenty of phosphates. The sediments contained a few pus cells but no red cells nor casts.

*Subsequent progress of the case.*—After his admission into the hospital, appropriate treatment was started but as the dyspnoea did not improve, the right pleural cavity was aspirated on 13th April and 8 ounces of greenish coloured pus was taken out. Bacteriological examination revealed the presence of pneumococci in large numbers. On the next day, paracentesis of the abdomen was done and 42 ounces of pus of a similar nature was withdrawn. Bacteriological examination showed a pure growth of pneumococcus. When the distension was relieved a fairly big mass, apparently loculated pus, could be felt in the right hypochondriac region. As the abdomen filled up again, a second paracentesis was performed and 48 ounces of similar pus withdrawn from the peritoneal cavity. This improved the general condition of the patient and brought down the temperature to 99.5°F. Now the peritoneal cavity was drained by closed drain method through a supra-pubic incision, and several pints of pus came out in the course of a week. The mass in the right hypochondriac region disappeared and the patient slowly and steadily made an uneventful recovery. Of course throughout the period of his stay in the hospital, appropriate medical treatment including administrations of sulphapyridine and injections of pneumococcal immunogen were given

to the patient. He was discharged from the hospital on 17th June as a healthy robust child.

From a study of the above case record it will be seen that the boy got an attack of generalized pneumococcal infection which affected his lungs as well as his pleural and peritoneal membranes. - Somehow or other, he managed to put forth an adequate immunity to localize the organisms which finally settled in the serous membranes giving rise to a suppurative inflammatory process. The amount of exudate in the peritoneal cavity became very considerable and hence the distension was also very marked. Although the immunity was just sufficient to localize the infective elements, it was not adequate to cause their death and lysis and hence the pneumonic changes in the lungs failed to undergo complete resolution and was found in a state of delayed resolution. This latter however cleared up completely when the necessary treatment was started to kill the pneumococci and remove their exudate from the pleural and peritoneal cavity. The presence of diarrhoea at the outset and the irregular bowel action during the subsequent period of the illness may be noted. The combination of pneumococcal peritonitis with empyema on one side and unresolved pneumonia on the other is extremely rare.

Pneumococcal peritonitis is a disease of children and its incidence is undoubtedly greater in the female sex. A primary infection of the peritoneum is extremely rare. Usually it is secondary to an infection in some other part of the body. Owing to its preponderance in the female sex, it has been suggested that the organisms spread through the genital tracts. But this is very difficult to believe when we find that the disease also occurs in a fairly large proportion of boys. Besides, bacteriological examination of the genital canal of girls often proves negative. An investigation of this nature carried out by Dr. Nabarro, pathologist to the children's hospital at Great Ormond Street, amongst London children proved conclusively that pneumococci were not always found in their vaginal discharge. It is now a universally accepted belief that the organisms reach the peritoneum via the blood stream from a primary focus in some part of the respiratory passage. A severe sore throat, tonsillitis, otitis media, acute laryngitis, pneumonia, and broncho-pneumonia may serve as a focus from which showers of pneumococci are discharged into the blood stream and in the absence of an adequate defensive reaction they may lodge anywhere in the body and start their morbid changes. In this way, the occurrence of serous membrane involvement can be easily explained. But what is more difficult of explanation is the fact that it occurs almost exclusively in children. Whether it is the defensive architecture which is naturally immature or a special predilection brought about by an as-yet-unknown factor still remains to be explained.

### Diagnosis

The clinical picture of pneumococcal peritonitis is fairly characteristic in many instances. The most important thing is that one must always keep an open mind regarding the existence of such a condition. The illness may begin with overwhelming suddenness but more usually there are 2 or 3 days of indefinite fever, malaise and catarrh of the upper respiratory tracts. Vomiting, diarrhoea and abdominal pain may be very early as in the case mentioned. The temperature is usually high and the pulse and respiration are much increased. The abdominal pain is not of a colicky nature but more or less diffuse and constant. This is soon followed by distension, rigidity and tenderness all over the abdomen. If there is a concomitant involvement of the lung or pleura pneumococcal infection is suggested. If on the other hand no lung signs develop, one is liable to make a diagnosis of general peritonitis due to acute appendicitis. A definite diagnosis at this stage is wellnigh impossible. A careful history, colicky nature of the pain which is more central in the beginning, maximum tenderness in the right iliac region and a board-like rigidity are however some of the features which may suggest acute appendicitis. In pneumococcal condition, the abdomen has a doughy feel, the face is flushed, the skin is hot and burning, the respiration hurried and there may be cyanosis. Herpes may be present. Besides acute appendicitis, the condition may be confused with septicæmia and peritonitis due to infection with hæmolytic streptococci. This confusion is worse when the intensity of toxæmia is very great and the infection overwhelming. The diagnosis, in such instances, can be settled either by laparotomy, or on the autopsy table. When the condition is of long standing and is not associated with much toxæmia, the suggestion of tuberculous peritonitis is very strong. Signs and symptoms of tuberculous toxæmia such as rapid loss of weight, marked sweating, troublesome dyspepsia, and diarrhoea with large pale frothy evacuations would be wanting, whereas a high leucocyte count with increased percentage of polymorphonuclear neutrophils would be definitely against it. Signs of consolidation in the lung and effusion into the pleural cavity helped us in our diagnosis of the case under review, as the fluid withdrawn from the right pleural cavity revealed the infecting organisms.

### Prognosis

Next to tuberculous peritonitis, this condition has the most favourable outlook. A good deal depends on the mode of infection, i.e., whether it is an acute diffuse infection, acute infection passing into a subacute or chronic phase or early localization into the peritoneal cavity with formation of big collection of pus. In the last two conditions the prognosis is favourable and if appropriate treatment is instituted, recovery takes place. But in the first condition which is

a part of a septicæmia, recovery is rare. Other factors which determine the ultimate recovery are the presence of a co-existent pneumonia, involvement of other serous membranes such as the pleura, pericardium and the meninges and the existence of devitalizing constitutional diseases, such as Bright's disease, diabetes, and chronic splenomegalic conditions. In these days, the outlook has also been considerably modified by the discovery of new and powerful chemotherapeutic drugs.

### Treatment

This is a fairly simple matter when the infection has localized and pus formation has taken place. Simple drainage with treatment of the infection in other parts, such as the lungs and the pleural cavities, will clear up the condition in the majority of cases. But it is in the early diffuse type with overwhelming infection that the problem of treatment is very unsettled. This condition is a blood-borne infection and is a manifestation of septicæmia with a diffuse peritonitis leading to matted coils of intestine and collections of pus shut off from the general cavity. Obviously drainage cannot be effective in such a condition. Moreover, a major surgical operation on the peritoneal cavity may be just sufficient to cause a break-down of the last resistance of the child and determine a fatal issue. It is a matter of common experience that acute general peritonitis is a very fatal disease whatever may be the treatment. In such a malady, conservative treatment may be able to convert an acute into a chronic condition with residual abscess formation when the chances of cure would be much greater.

Under circumstances where a definite diagnosis cannot be made, one must always bear in mind that an acute gangrenous appendix may remain in the background and unless a quick surgical operation is performed, the result may be fatal. In such a case a quick laparotomy should be done under gas and oxygen to find out the condition inside the abdomen leaving a pelvic drainage.

If the amount of exudation be very large, as in the case reported, it is better to do one or two preliminary paracenteses before undertaking surgical drainage. At the same time all attempts should be made to mobilize the defensive forces of the body by adequate easily assimilable nourishing diet containing enough vitamins, sulphanilamides, and massive doses of iron and tonics.

The writers take this opportunity to acknowledge their sincere thanks to Lieut.-Colonel J. C. De, I.M.S., superintendent, Medical College Hospitals, for permission to publish the records of the case. Their thanks are also due to Dr. K. K. Ghose, resident surgeon, Medical College Hospitals, for his surgical assistance and to Prof. B. P. Tribedi for the bacteriological reports.



## CHEMOTHERAPY IN THE TREATMENT OF CEREBROSPINAL MENINGITIS

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NINE cases of cerebrospinal meningitis occurred in the Hazaribagh Central Jail, which has an average population of about 1,000, between the 1st April and 17th May, 1940, out of which three died and the rest recovered.

**Chemotherapy.**—M. & B. 693 and proseptasine with anti-meningococcal serum were tried in all except the two fulminating cases. As there was a shortage of M. & B. 693 which was obtained after some delay, proseptasine which was in stock was given to supplement the drug in four cases. The drugs were administered orally, being crushed and given as a suspension in water.

The number of cases treated is too small to warrant the drawing of conclusions, but lends additional support to the efficacy of the combined treatment with serum and sulphanilamide groups of drugs in reducing the mortality rate. In view of the fact that such treatment is comparatively a recent innovation the details of the cases are briefly recorded.

### *Details of the cases*

**Case 1.**—Hindu male, aged 25 years, under-trial prisoner, admitted into jail on 21st March, 1940, was admitted into the jail hospital on the morning of 1st April, having had fever with rigor on the previous night; temperature on admission was 102°F. Blood film was negative for malarial parasites. On 2nd April the temperature came down to 97°F. and rose up to 100°F. in the evening. The same happened on 3rd April, but the patient was stuporose and had considerable neck rigidity and a bilateral positive Kernig sign. Lumbar puncture disclosed turbid cerebrospinal fluid under pressure.

Bacteriological report of the cerebrospinal fluid revealed microscopically Gram-negative intracellular diplococci, numerous pus cells and a few lymphocytes, on culture, sterile up to 72 hours' incubation in blood agar tubes heavily inoculated with the fluid.

The temperature range was low, between normal and 99°F. By the thirteenth day no sign of meningitis remained and his progress was good, he was free from pyrexia and cheerful and bright. His convalescence was uneventful and he was discharged from hospital on 1st May, but kept in convalescent gang. M. & B. 693 tablets with anti-meningococcal serum intrathecal and intravenous were given; details are shown in a separate table.

**Case 2.**—Hindu male, aged 20 years, under-trial prisoner, admitted into jail on 17th March, 1940, was received in the jail hospital in the evening of the 7th April, history of rigor, temperature 104°F., pulse rate 120, respiration 22, spleen palpable, no stiffness of neck, no Kernig sign, lungs clear. At about 4-30 a.m. he had convulsion and became comatose, and died two hours later at 6-30 a.m. on 8th April within twelve hours of admission. No lumbar puncture was done. Blood film was taken, no malarial parasites were found.

Post mortem—the meninges and brain were found intensely congested with deposit of fibrin. Ventricles and spinal canal were found dry, spleen 11½ oz., other organs deeply congested, otherwise healthy.

**Treatment.**—Cardiazol injection, intravenous glucose injections, and hydrotherapy.

**Case 3.**—Hindu male, aged 18 years, admitted into jail on 22nd April, 1940. Admitted into jail hospital on

1st May, temperature 104°F., pulse thready, respiration 40 per minute, no stiffness of neck, no Kernig sign, complained of headache and severe pain in the joints. At 5 p.m. the same day he became delirious, the next morning he became unconscious, no stiffness of neck, Kernig sign negative, pulse imperceptible, he died the same morning. Lumbar puncture revealed turbid cerebrospinal fluid under pressure; in a slide prepared from the fluid with methylene-blue, intra- and extra-cellular diplococci and numerous pus cells were found; unfortunately the ampoules containing the cerebrospinal fluid sent for bacteriological examination were broken during the transit.

**Treatment.**—Camphor in ether 1 c.cm. every four hours subcutaneously, glucose solution (25 per cent) 25 c.cm. intravenously, anti-meningococcal serum 20 c.cm. intrathecally and M. & B. 693 tablets 3 grammes.

**Case 4.**—Hindu male, aged 46 years, convicted prisoner, admitted into jail on 24th December, 1939, was received in the jail hospital from a ward in the same block as under-trial ward on the morning of 1st May, 1940. Temperature on admission 101°F., pulse rate 116, respiration 26, intense headache, no stiffness of neck, no Kernig sign. The next morning he was very irritable, stiffness of neck was present, and Kernig sign positive. Lumbar puncture revealed turbid cerebrospinal fluid under pressure. The ampoule containing cerebrospinal fluid sent for the bacteriological examination with that of case 3 was broken during transit, microscopically diplococci, and pus cells found.

**Treatment.**—Anti-meningococcal serum was given both intrathecally and intravenously and also M. & B. 693 orally. The temperature came down to normal on 8th May and the meningeal sign disappeared and patient was quite conscious. But on the 10th May he died in the evening of acute respiratory failure.

**Case 5.**—Hindu male, aged 32 years, convicted prisoner, admitted into jail on 15th February, 1940, was received in the jail hospital on the morning of 1st May, 1940. Temperature 104°F., pulse rate 140, respiration 36, complained of severe headache, no stiffness of neck, no Kernig sign, spleen palpable. In the evening he was very restless, irritable and stuporose, and a few discrete red papules were noticed over the front of the chest and abdomen. On the 3rd May, 1940, stiffness of neck and Kernig sign positive, condition almost same as before. On 4th May slight improvement in the mental condition was noticed and temperature had come down to normal. On 5th May, 1940, the temperature again went up to 102°F., and on 6th May it was 103°F., but gradually came down till it was normal on 12th May, when convalescence set in, the meningeal signs had disappeared, and the patient's mental condition was normal. He was discharged from hospital on 4th June.

**Treatment.**—M. & B. 693 was given orally and anti-meningococcal serum intravenously.

**Case 6.**—Hindu male, aged 23 years, under-trial prisoner, admitted into jail on 21st February, 1940, was brought to the jail hospital on 4th May (morning), temperature 101°F., pulse rate 110, respiration 28, complained of severe headache. Spleen was palpable, no stiffness of neck, Kernig sign negative. In the afternoon he became unconscious and stiffness of neck and Kernig sign were positive. Lumbar puncture revealed turbid cerebrospinal fluid under great pressure. On 5th May temperature was 99.5°F. and it gradually came down to normal on 8th May, when the meningeal signs had disappeared and consciousness was regained. He was convalescent and was discharged on 23rd May. Bacteriological report: microscopic examination—meningococci, intracellular and extracellular, found and on culture meningococci were grown.

**Treatment.**—As the stock of M. & B. 693 had been nearly exhausted, proseptasine tablets were also given orally to supplement it, with intravenous and intrathecal anti-meningococcal serum.

**Case 7.**—Hindu male, aged 30 years, under-trial prisoner, admitted into jail on 29th April, 1940. On 5th May he was admitted into the jail hospital with



temperature 101.5°F., pulse rate 108 and respiration 20. Spleen was palpable, no stiffness of neck, no Kernig sign, complained of headache. On the 6th he complained of very severe headache; stiffness of neck and Kernig sign were present and he had nausea. Lumbar puncture revealed turbid cerebrospinal fluid under pressure. *Diplococcus meningitidis* was grown on culture.

*Treatment.*—Intrathecal and intravenous anti-meningococcal serum and proseptasine and M. & B. 693 tablets were given orally. On the 12th, i.e., the 8th day of illness, the temperature was normal. He was discharged on 1st June, on the 28th day of his illness.

Case 8.—Hindu male, aged 30 years, convicted prisoner, admitted into jail on 4th January, 1940; he was admitted into jail hospital on 11th May with temperature 103.5°F., pulse 110, respiration 28, spleen palpable, stiffness of neck, and Kernig sign absent. Lumbar puncture revealed turbid cerebrospinal fluid under pressure. *Diplococcus meningitidis*, extracellular and intracellular, found in large numbers in the cerebrospinal fluid microscopically and also isolated on culture.

*Treatment.*—Anti-meningococcal serum was given intrathecally and intravenously and M. & B. 693 and proseptasine tablets orally. The temperature came down to normal on the sixth day of the disease and continued so till his discharge from hospital on the 4th June.

Case 9.—Hindu male, aged 35 years, admitted into jail on 17th March, 1940. On 17th May he was admitted into jail hospital with temperature 102.5°F., pulse

Hazaribagh Central Jail during April and May 1940. Four of these were fully authenticated meningococcal meningitis and in three, including the first case in which culture was negative, microscopical examination revealed diplococci. Of the remaining two one was a case of fulminating type being fatal within 12 hours, and in the other no cerebrospinal fluid could be withdrawn on lumbar puncture.

Excluding two fulminating cases, seven of these cases were treated with the sulphanilamide group of drugs, M. & B. 693 and proseptasine, a single spinal drainage and a single dose of intrathecal polyvalent serum (Bengal Immunity Co.) except in one case, and intravenous serum, with only one death.

Striking clinical improvement was noticed within three or four days of the commencement of treatment.

I take this opportunity of thanking Lieut.-Colonel A. N. Bose, I.M.S., Bacteriologist to the Government of Bihar, for kindly examining the specimens of cerebrospinal fluid submitted to him.

Table showing treatment and result

Case number	AMOUNT OF SERUM GIVEN IN C.C.M.		AMOUNT OF DRUG IN GRAMMES			Result	Actual period of illness in days	BACTERIOLOGICAL EXAMINATION OF C.S. FLUID	
	I. T.	I. V.	M. & B. 693	Proseptasine	Total			Smear	Culture
1	10	30	16.5	Nil	16.5	Cured	13	+	—
2	Nil	Nil	Nil	Nil	Nil	Died	$\frac{1}{2}$	..	..
3	20	Nil	3	Nil	Nil	"	1	—	..
4	20	50	18	Nil	18	Died (acute respiratory failure).	10	—	..
5	Nil	80	16	Nil	16	Cured	12	..	..
6	10	40	6	25	31	"	5	+	+
7	10	70	15	26	41	"	8	+	+
8	10	75	12	13	25	"	6	+	+
9	10	50	6	10	16	"	5	+	+

rate 136 and respiration 40, slight headache, no stiffness of neck or Kernig sign present. Fine crepitant râles were heard over the base of the right lung. Lumbar puncture revealed turbid cerebrospinal fluid under pressure. Microscopically large number of pus cells and Gram-negative diplococci present; *Diplococcus meningitidis* was isolated on culture.

*Treatment.*—Anti-meningococcal serum intrathecally and intravenously and M. & B. 693 and proseptasine tablets were given orally. Temperature came down to normal on the second day of disease but there was a sharp rise to 102°F. on the fourth day with a drop to normal the next day; his temperature was normal till his discharge on the 4th June.

#### Summary

Nine cases of cerebrospinal meningitis were treated in the hospital attached to the

I am also grateful to Lieut.-Colonel O. R. Unger, I.M.S., Inspector-General of Prisons, Bihar, for his kind permission to publish the cases.

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## KANGRI-BURN CANCER

By ERNEST F. NEVE, M.D., F.R.C.S. (Eng.),  
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How strange it seems that an earthenware bowl, basket covered and surmounted by a wicker handle, should be able, when held under a pheran against the body, to wreak such mischief. From the mouth of the bowl, under the handle, direct heat is given off from the glowing wood charcoal, but heat also passes through the walls of the kangri and the wicker work in which it is enclosed. I have tested the temperature to which the skin is exposed. *In situ* it ranges between 150° and 200°F. The wood charcoal, which is put into the kangri, is obtained from various sources—willow, witch hazel, chenar leaves, and sometimes pine-wood.

*Ætiology.*—The theory has been put forward that the cancer is due to chemical vapours given off by the charcoal. In support of this idea, the experiments with coal tar on rats and mice, and the chimney sweeps' cancer due to contact of soot with the skin have been adduced.

One thing is quite certain that *irritation* is a cause of cancer. It is common knowledge that any little innocent superficial growth, warty or otherwise, is in danger, especially in elderly people, of taking on malignant action, if it is perpetually rubbed, scratched or treated with caustics.

There is still one school of thought which believes cancer to be a parasitic disease due to some particular form of contagion. The cancer from which fowls suffer, and the interesting work of Barnard and Gye are quoted in support of this view. I think that it is quite evident that the Kashmir kangri-burn epithelioma is produced by heat apart from products of combustion and it is in no sense a parasitic disease due to micro-organisms.

I remember a case in the Edinburgh Royal Infirmary 60 years ago when I was a student, a man with a fungating ulcer on the front of the leg. He was under my care. The history was that his work was in a comb factory, and that his leg rested against a hot water pipe, in connection with which this ulcer had arisen, and increased. Looking back I can now see clearly that this was an epithelioma of the same type as the kangri-burn cancer. The surgeon in charge appeared in doubt, and wanted to take a small piece and examine it microscopically; the man objected and decamped.

The effect of heat, in my opinion, is evident. The epithelioma of the lip from smoking clay pipes, and now sometimes seen as the result of cigarette smoking. Cancer of the tongue may

be similarly produced; but any *chemical irritation* may have a similar action, as for instance in the *betel* chewers' cancer, so common in south India. The frequent application of coal tar in the experiments on rats, and the ensuing cancer is another case in point.

With regard to kangri-burn cancer I think that there can be little doubt that continued exposure to heat, going on over long periods, beginning perhaps in childhood and extending over adult life to old age is the exciting cause. Very often, at one time or another, there has been a severe burn, with a resulting scar. Such scars are peculiarly liable to be attacked. The cancer does not, however, usually develop until middle or old age. The average age indeed of those coming under observation with this disease is between 50 and 60. Only about 7 per cent of the cases are in people over 70. Kangri-burn cancer is considerably more common in men than in women. This may perhaps be explained by the fact that the domestic occupations of women do not admit of very continuous use of the kangri. In connection with the difference in the sexes of liability to certain types of cancer, I have been told that in China the men are much more liable to carcinoma of the stomach than the women, and the alleged reason was that the men eat their rice very hot, whereas the women have to wait until the men have finished, by which time the rice is no longer hot.

*Nature of the growths.*—Many elderly Kashmiris exhibit small localized papules or macules on the skin, with a tendency to epithelial overgrowth. These may be found on any part of the body, even those not exposed to heat irritation. They are however more abundant on sites exposed to the direct action of the kangri. It is just possible that irritation owing to heat applied in one area may stimulate epithelial growth elsewhere. Certainly at the seats of election of the cancer, the anterior surface of the abdomen above or below the umbilicus, the epigastric region, and even sometimes the lower part of the front of the chest, also often the inner sides of the thighs, the little epithelial plaques are found in varying stages of development from simple papules with a scaly surface, or raised warty areas or horns sometimes reaching an inch in length, up to the actual squamous epithelial cancer. Owing to the constant application of heat, the skin of the abdomen or inner aspect of the thighs is apt to appear dry and parchment-like. The course of the superficial veins may be mapped out by brown pigmentation. Every degree of chronic dermatitis may be met with, from mere redness, with or without desquamation, to actual scars, the result of destructive burns. These scars are especially liable to become the starting points of malignant action. Thus we have, under observation, in different patients, every stage from the earliest signs of epithelial proliferation to the most advanced cancerous growths

\* We regret that we did not receive this contribution in time for our 75th anniversary number. Dr. Neve must be our oldest active contributor; his first contribution on 'The Evolution of Antiseptic Surgery; a Retrospect' appeared in the June number, 1893.—EDITOR, I. M. G.

with secondary deposits in neighbouring lymph nodes.

The lesion starts at the surface. It is a local disease from a local cause. It is never found on the back or extensor surfaces of the arms, but the anterior aspect of the thighs may sometimes be affected. The hands, face and feet enjoy immunity.

The evidence of the kangri-burn cancer is indeed strongly against the parasitic theory of the origin of cancer. It is noteworthy that the disease is apt to supervene at the period of life, when active, vigorous growth and development are slowing down, or have ceased, and when the endocrines which act as stimulants and controlling agents are no longer powerful.

*Histology.*—In the early stages of the kangri-burn cancer, ulceration is absent, and the growth consists of a mere warty thickening of the skin. Examined microscopically, the epidermis is seen to be much thickened, and underlying it an infiltration of new epithelial cells can be demonstrated tending to obliterate the papillæ. In a more advanced stage a breach of continuity is seen to have taken place in the surface and there is an ulcer with a ragged floor, the papillæ are hypertrophied, the nuclei of the stratum granulosum are prominent and sharply defined, and the cells of the corium are actively proliferating. There are some cell nests, and numerous minute blood vessels without unstriated muscle.

*Gross pathology.*—Macroscopically, there are three common forms of this cancer. The commonest is an ulcer more or less circular or oval, about an inch and a half in diameter, with raised irregular edges and deep crater-like centre. Sometimes part of the tumour is fungating and in other parts there are deep pockets.

The second form, which is less common, is a growth consisting of a cauliflower-like excrescence, which may project one or two inches from the surface and measure two to three inches across.

The third form is met with in those of more advanced years. Here there is little apparent over-growth, but small or large ulcerated areas with irregular steep edges, in places undermined, and a rugged floor rendered uneven by deep recesses.

These cancers, when ulcerated, are always very foul and the skin is sodden with septic discharge, which dries and becomes adherent at the margins and to some extent on the surface of the growth.

*Glandular infection.*—Lymph nodes become infected fairly soon, especially where the stage of ulceration has been reached. In the thigh, not only are those along the saphenous vein and in Scarpa's triangle involved, but, in advanced cases, the deep femoral and external iliac and inguinal lymph nodes near the pubis are also affected, especially the external pubic. In lesions of the abdominal wall, if below the umbilicus, the external iliac and inguinal

lymph nodes are attacked; if above the umbilicus, the anterior axillary lymph glands may be involved, or even deep glands beside the axillary vessels, and occasionally the subscapular glands. Not infrequently small enlarged lymph nodes are found across the side of the chest between the epigastrium and the axilla; this is however quite exceptional.

In advanced cases the infected glands may attain the size of a pigeon's egg, and they may become mere bags of soft epithelial debris, very septic if ulceration has occurred. When these nodes break down the result is absolute disaster. Diffuse infiltration occurs, the overlying skin becomes red and brawny, and suppuration persists.

Under these conditions the secondary deposit presents an appearance more or less approximating to that of the primary growth, except that the ulcer is deeper and the discharge more abundant and foul.

After months or possibly years of suffering, the patient dies of exhaustion, septic intoxication, or from hæmorrhage, for sometimes the femoral or axillary artery may be opened into by ulceration.

The malignancy of these epitheliomata does not seem to be great. We often obtain a history of from one to five years' duration, sometimes much longer. More than 50 per cent of the cases show secondary infection when first seen by us.

*Hospital statistics.*—During fifty years, 3,064 operations were performed in the Kashmir Mission Hospital for kangri-burn epithelioma; 44 deaths occurred after operation, or rather over 1.3 per cent. It must however be remembered that in some cases there was recurrence and in others infected lymph nodes, undiscovered at the time of operation, may have developed.

*The nature of the operation.*—This is a very important point. Where, as is usually the case, there are enlarged lymph nodes these should first be dealt with and they require very careful handling to avoid rupture and possible wound infection from their contents which may also be septic. Small glands are very apt to escape notice, especially the external pubic group. In order to avoid septic contamination of the operation wounds before proceeding to the removal of the primary tumour, very great and thorough care must be taken in cleansing the surrounding skin, with oil of turpentine, following it up with 1/500 mercury-iodide spirit lotion. The great technical difficulty is to prevent contamination from the fungating growth itself during the operation. Sometimes the actual cautery is used to sterilize the surface of this. Sometimes it can be secured in double cyanide gauze as an additional precaution, or it can be subjected to a few days' preliminary treatment with chloride of zinc, 40 grains to the ounce. Then comes the test of operative skill. There is a knack in excising the primary growth.

With the aid of three or four volsella fixed in the skin around and well beyond the tumour and held well up by an assistant, the tumour is excised by a rapid clean incision, most carefully avoiding contaminating contact with the dangerous septic growth in such close proximity. Sometimes underlying muscle needs removal and occasionally small areas of peritoneum. In the latter case it is essential to ensure subsequent sound approximation of edges without tension.

With regard to infected lymph nodes, ill-defined induration and redness of surrounding skin is a contraindication to operation. Sometimes it may be worth while to excise the primary growth, even if the glands are inoperable.

In very bad cases in which, after operation, in spite of every precaution the wound becomes septic, Carrel's irrigation with 0.5 per cent hypochlorite is very effective.

*Recurrences.*—Many cases, when first seen, are really too advanced for surgical treatment. Others, returning to their homes after operation, disregarding the serious warning which they have received, continue to use the kangri, and, if they come back for treatment, it is difficult to say whether the recurrence which sometimes follows is the result of an incomplete operation or whether fresh neoplastic formation has been provoked by the continuance of the original irritant. If the lymph nodes are affected, in such returning cases, and the recurrent growth quite small, it is probably due to incomplete operation, some of the previously infected glands having escaped removal.

So far as we have been able to ascertain end results, we are of opinion that the proportion of recurrent cases is less than 20 per cent. Where lymph nodes are affected, experience has shown that it is not necessary to perform such extensive and drastic operations as those often necessary for carcinoma, for instance, of the breast. The malignancy of the kangri-burn epithelioma is not great, the actual lymphatic vessels appear to escape the infection which is transmitted to the nodes, and, if early operation is resorted to, the distribution of the lymph nodes remembered, and careful examination resorted to, the proportion of cases of complete recovery is much higher than after operations for carcinoma or sarcoma.

### Conclusion

To sum up, the special importance of the kangri-burn cancer is the relation which it bears to the causation of cancer. Here is the case of a growth arising from a definite physical irritant, namely, heat rays. This places it in the same group as those produced by, for instance, x-rays and other physical or chemical irritants. It would appear that this direct irritation starts epithelial proliferation. The waning influence of endocrine balance, which becomes more marked in elderly people, and the loss of a

(Continued at foot of next column)

## NON-SPECIFIC INFLAMMATION OF THE LUNG

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ROUTINE radiographic examination of the lungs of patients attending a well-run chest clinic leads to the discovery, in some, of transient opacities in the lung fields, unaccompanied by the recognized symptoms of the classical types of pneumonia. Maxwell (1938), Gill (1938), Allen (1936) and others have given the name pneumonitis to a variety of these opacities. Ramsay and Scadding (1939) have analysed 21 cases with circumscribed shadows in the radiogram of the lungs. They criticize the nomenclature pneumonitis as applied to these lesions and suggest 'benign circumscribed pneumonia' as a more precise description. The writer has come across 11 such cases with localized opacities in the lung fields two of whom were treated as in-patients while the remaining nine attended the out-patients' lung clinic attached to the King George Hospital, Vizagapatam.

The age incidence varied from 5 to 46 years. Three were between 5 and 8, one was 12, and the remaining were above 15.

Out of the 11 cases only three were females.

Four patients gave previous history of asthma of duration varying from six months to two years. Two had suffered from recurrent colds followed by tracheo-bronchitis. The remaining had no previous respiratory troubles.

Only in three cases the onset was sudden with high fever. All the remaining eight patients sought advice in the clinic for slight cough and fever of varying duration not exceeding four weeks.

Cough was the presenting symptom in all the cases but one. Fever was present in all. But the degree of fever was very variable. In the two cases which were treated as in-patients the temperature remained high and continuous for the first 15 days or so after which period the fever came down by lysis. With only one single exception cough was associated with expectoration in all. In none of them was the

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measure of trophic nerve control, allows these epithelial elements to escape regulation and form new growths.

This exact aetiology is of course speculative. For we know so little about the precise details of the control of growth, of the skin for instance. On a healing granulating surface we put a Thiersch skin graft or use Reverdin's method; that skin grows. Why does it stop growing when it has filled its needed space?

The one point about the kangri-burn squamous epithelioma is that its exciting cause is demonstrable and that parasitic origin appears to be most improbable.

PLATE IV

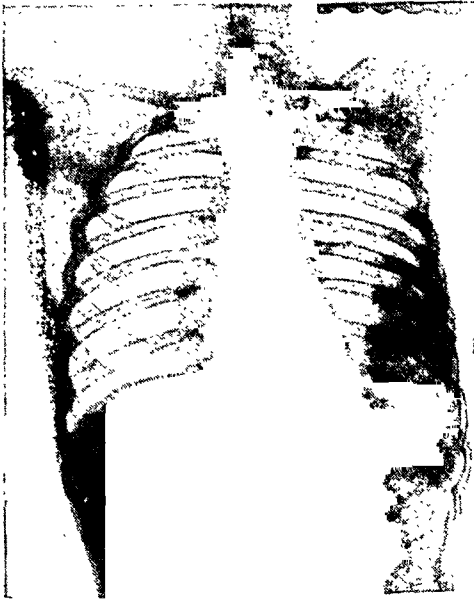


Fig. 1. Case 1.

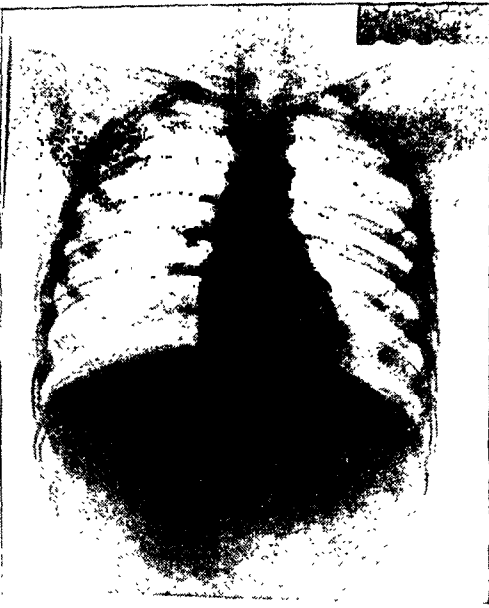


Fig. 2. Case 1.



Fig. 3. Case 2.

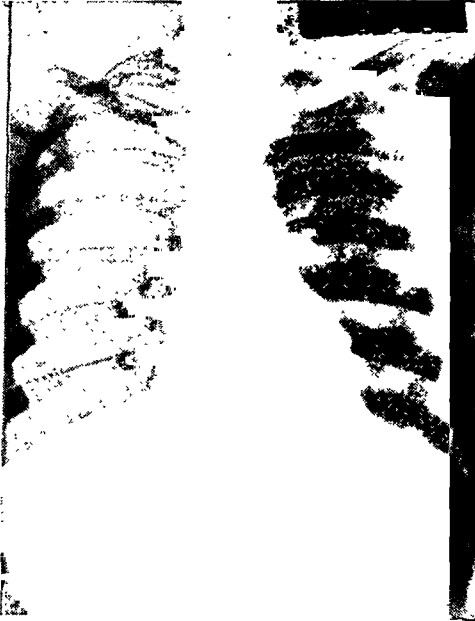


Fig. 4. Case 2.



Fig. 5. Case 3.



Fig. 6. Case 3.



sputum blood stained. Most of the patients complained of lassitude, loss of weight and loss of appetite. The period of disease varied from two to eight weeks. The symptoms subsided one or two days earlier than the disappearance of the lung shadows in the radiographs.

Physical signs were very variable. No abnormal signs could be found in three cases. In four cases localizing signs, such as impaired resonance and few moist sounds could be elicited. In one case all the typical signs of localized consolidation were found. Three cases showed signs of bronchitis only.

Radiographs showed circumscribed opacities of more or less uniform density in practically all cases. They varied in size from that of an anna-piece to that of an orange. All but one were situated in the lower lobe.

*Discussion.*—The interest in these cases is stimulated by the fact that their symptoms simulate those of active tuberculosis. Even the radiographic opacities may be mistaken for tuberculous caseating patches or specific allergic reactions in the lung going by the name epituberculosis. Tuberculosis can easily be ruled out in these cases by the absence of tubercle bacilli in the sputum and the complete disappearance of the shadows in a comparatively short time.

Jeanneret and Famé (1933) have reported some very transient radiographic opacities observed in the course of routine examination in both normal subjects and patients with pulmonary tuberculosis without any symptoms whatsoever. They attributed them tentatively to atelectasis without supervening infection. That the cases in the present series had no atelectasis was shown by the rounded shape of the radiographic shadows and by the absence of mediastinal shifting even in those with large opacities.

The question that naturally arises is about the nature and causation of such localized inflammation of the lung tissue, which differs so markedly in their clinical manifestations from the classical types of pneumonias. The classical work of Blake and Cecil (1920) has shown that the organisms penetrate the bronchial walls and spread by the perivascular, peribronchial and septal interstitial tissue. Sharpe and Blake (1930) and Fried (1933) have performed experiments in which pneumonias were produced as a specific response to endotracheal introduction of substances to which the animal has been rendered hypersensitive.

The other mode of production is by aspiration of infected material as shown in the experiments of Terrel, Robertson and Coggeshall (1933). Amberson (1937) has emphasized the importance of aspiration of infected mucus as a cause of pneumonia. He showed that lipiodol introduced into the nose of a sleeping individual could be demonstrated in the alveoli. Ikeda (1937) has reported numerous instances of oil aspiration occurring after oily substances were

introduced into the pharynx. In the same way there is every possibility of excessive secretion of infected mucus in the course of respiratory catarrhal infections producing pneumonic consolidations in the lung. Even by this mechanism lobar consolidation can occur either by confluence of lobar aspiration foci or as a complication of a massive lobar collapse (Ramsay and Scadding, *loc. cit.*).

The mechanism of production of circumscribed pneumonic consolidation is a matter for conjecture as none of the cases had a fatal termination to make autopsy possible. The aspiration mechanism is however more probable because of the pre-existing catarrhal affections in many of the cases. The previous history of asthma in some cases suggests another possibility of local allergic reaction in the lung.

No doubt these cases of benign circumscribed inflammations of the lung form a separate group because of their distinctly benign course, irregularity of symptoms and signs, and the variable duration of the affection. But are we justified in grouping them together as a separate clinical entity? The differences in the clinical manifestations of the three forms of inflammatory reaction of cellular tissue, namely, non-suppurative inflammation, abscess and cellulitis are only due to the difference in the virulence of the infecting organism and the resistance of the host. A close analogy can be drawn between the three inflammatory reactions in cellular tissue and the three types of inflammation in the lung tissue, namely, circumscribed pneumonia, abscess of the lung and acute lobar consolidation. Are we not justified in surmising that these different inflammations differ only in degree and that the differences in the clinical manifestations depend only on the virulence of the organism and the resistance of the host? The possibility of localized pneumonitis as being the cause of idiopathic abscess of the lung has been suggested by the writer (1939). But as the prognosis in the various forms of inflammation of the lung differ very markedly indeed it would be advisable to recognize them as separate groups though the essential pathogenesis in all the forms may be the same.

#### Case notes

*Case 1.*—Hindu male, 24 years, history of irregular fever, cough and dull ache on the left side of the chest for ten days. The radiograph (figure 1) on admission shows the dense opacity at the left base. Another (figure 2), two weeks later, shows almost complete clearing up of the opacity.

Sputum—No tubercle bacilli were found. Culture showed pneumococci and streptococci.

*Case 2.*—Hindu male, 20 years, history of fever in the evening for 20 days, and dry cough for seven days. No pain. The radiograph (figure 3) on admission shows a dense opacity at the right cardiohepatic angle; figure 4, 16 days later, showing complete clearance.

*Case 3.*—Hindu female, 14 years, history of fever in the evening, cough with slight expectoration of six weeks' duration. Mantoux test negative. Sputum negative for tubercle bacilli. Culture showed pneumobacilli and hemolytic streptococci. Treated with

(Continued at foot of next page)



## A PRELIMINARY STUDY OF PLAGUE AT A HILL STATION IN THE NILGIRIS, SOUTH INDIA

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THE Nilgiris district has long been recognized as a potential plague zone. Potato farming is extensive in the whole district and in recent years it has become increasingly popular even as a cottage industry near the towns of Ootacamund and Coonoor. That field rats abound in potato farms is common knowledge. The health-conscious public of these towns have been, of late, much concerned with this problem of potato cultivation *vis-à-vis* plague, and attempted to discourage potato farming around residential areas by municipal legislation. The matter thus came to the notice of Government who ordered an enquiry into this matter to be made. The enquiry was accordingly carried out during the period May to July 1939, facilities for work being provided at the Pasteur Institute, Coonoor. The scientific aspects of this enquiry are included in this report. Field studies on plague undertaken in recent years at the instance of the Government and the Indian Research Fund Association in this province have all been connected with factors prevailing in the plains. The present enquiry has therefore contributed certain preliminary data pertaining to the epidemiology of plague in a hill station.

The Nilgiris is a plateau in South India, the smallest in extent and population of all districts in Madras province. It is roughly 1,000 square miles in extent upheaved at the junction of the

Eastern and Western Ghats, and has a population of about 170,000. The plateau has an average altitude of 6,500 feet though some of its peaks are over 8,000 feet high. The attached map shows the topography, and main routes of communication of the district. Over half the area is either forest or downs, a third is cultivated, and the rest is sparsely populated. The fertile areas in the district are chiefly composed of a rich black loam of a peaty nature. A brown soil comes next in value while other soils of inferior quality are chiefly used as grazing grounds. Of the lands utilized for agricultural purposes, less than half is cultivated with cereal crops, such as rice, wheat, *ragi*, *samā*, and barley, and over half with coffee, tea, cinchona, potato, etc. No portion of the district is irrigated. The grain grown in the district is hardly sufficient for 4 months' consumption in the year, and therefore much of these are imported either from Mysore and Malabar, *via* Gudalur, or from Coimbatore *via* the ghat road and the rack railway. Potato farming is very extensive, even as a cottage industry within the towns.

*Climate.*—The Nilgiris, owing to its high altitude, has one of the most temperate and equable of climates. Thus, for Ootacamund the average minimum temperature for the warmest month (April) is only about 9° higher than that for the coolest month (January) and the maxima for the same months vary only about 7°. Chart 1 shows the average monthly meteorological record for Ootacamund and chart 2 shows the average monthly plague death rate per mille of estimated population for the district for 35 years ending 1939. The annual rainfall averages about 67 inches, though it varies widely within the district from nearly 162 inches at Devala to about 56 inches in Ootacamund, depending on the effects of the south-west monsoon in each place. The humidity is low during the first 5 months of the year, and comparatively high during the remaining months. It has not been possible to procure necessary data for calculating average figures for saturation deficiency.

(Continued from previous page)

sulphanilamide. Figures 5 and 6 show radiographs taken before and ten days after treatment.

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### Plague in the Nilgiris

Plague first occurred in this district in Gudalur taluk about January 1903, and in Ootacamund in June of the same year. The disease then spread widely and rapidly all over the district and has been endemic ever since. The incidence of the disease has, however, been steadily coming down from the peak reached in the earlier years, though even with this decline a rough 3 to 4-year periodicity is evident, *vide* chart 3.

A special feature of the general incidence of plague in this district is, as stated in the geographical survey of plague in the Madras Presidency by Colonel Russell, that the usual difference between summer and winter months is not so clearly marked as in other districts (*vide* chart 2). This point is discussed later.

Another feature is that, unlike what now occurs generally in other districts, the urban

areas of Ootacamund and Coonoor, comprising only about a fiftieth of the total area of the

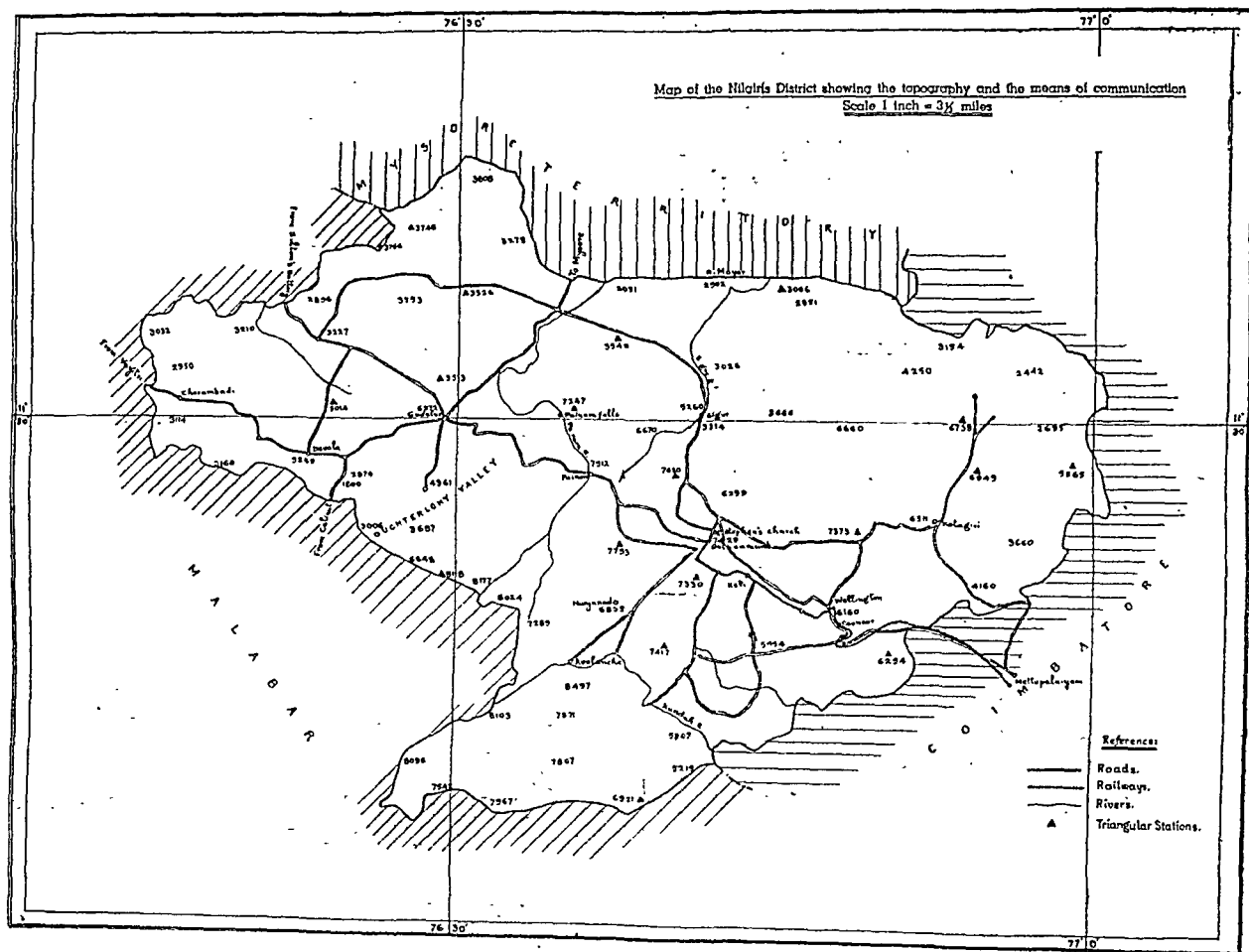
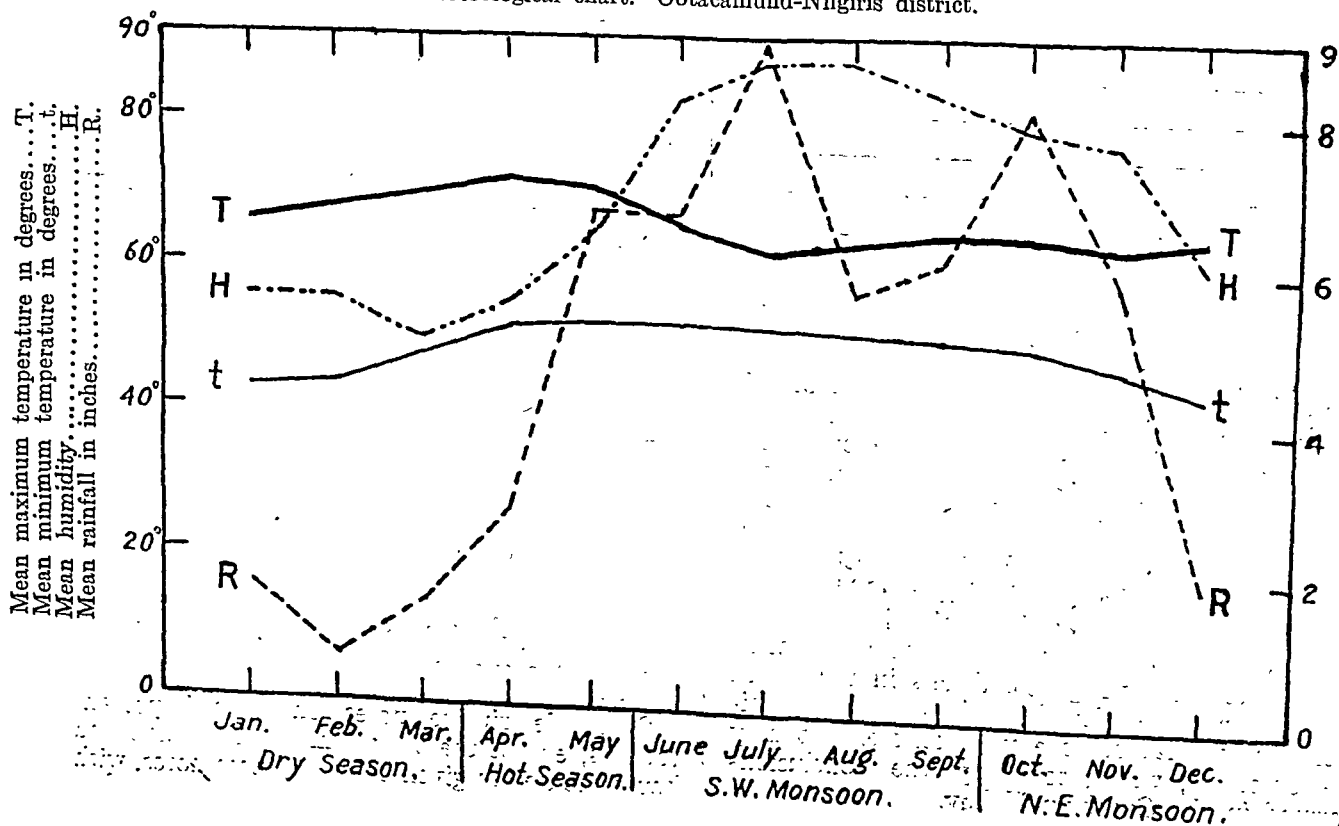


CHART 1

Meteorological chart. Ootacamund-Nilgiris district.



district and a quarter of its population, have been responsible for over 50 per cent of its total plague incidence.

**Pneumonic plague.**—Cases of pneumonic plague have occurred in the district at irregular intervals. Colonel Hutchinson, quoted by Wu Lien Teh (1926), reviewing the 10-year period 1913 to 1922, has recorded four limited pneumonic outbreaks in the Nilgiris, stating that 24 out of the 94 cases recorded in the whole province occurred in this district.

The chief lines of study undertaken during this enquiry were :—

(1) Study of rodents and fleas prevailing in this district with special reference to wild rodents in relation to plague.

(2) Transmission experiments with *Stivalius* and *Ceratophyllus* fleas.

The material for the enquiry was collected from various parts of the district through the co-operation of the planters and the officers of

CHART 2

Average monthly plague death rates, 1905-1939. The Nilgiris district.

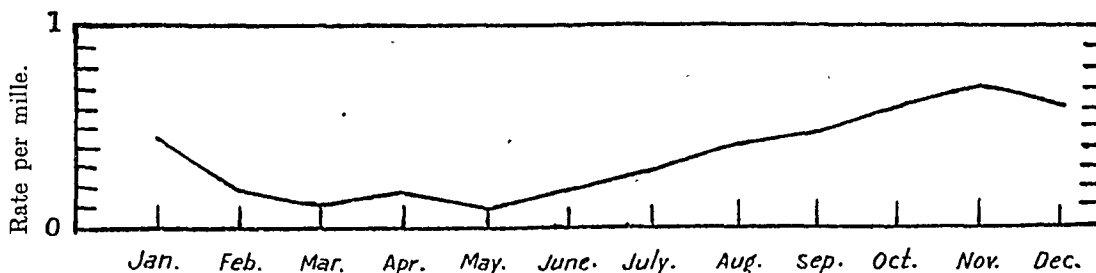
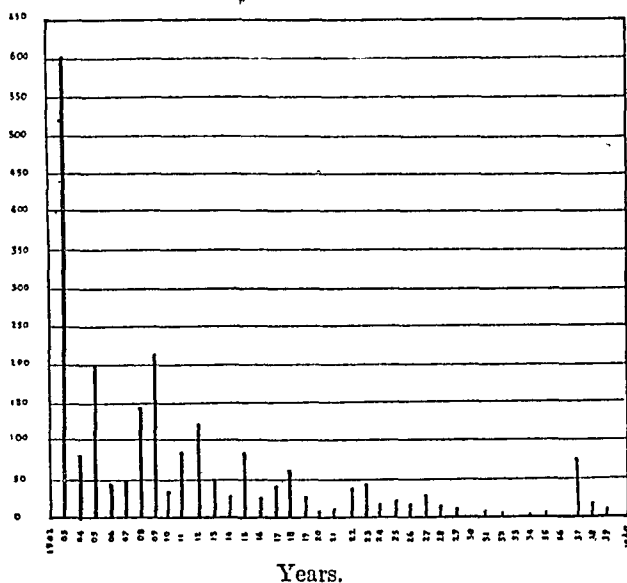


CHART 3

Deaths from plague in Nilgiris district during the years 1903-1939.



**Sylvatic plague.**—One of the purposes of this enquiry was to find out whether sylvatic plague actually existed now or whether the prevailing factors are favourable to its onset hereafter. Generally speaking, sylvatic plague does not seem to have interested plague workers in India. Studies in the Cumbum Valley, South India, reported by George and Webster (1934), and subsequent work show that sylvatic plague as such does not exist there. Cumbum Valley represents the average conditions in the plains of this province. In the Nilgiris where epidemiological factors are very different, it may be, after all, wrong to apply the conclusions formed in the Cumbum Valley.

the public health department of the district and by ourselves. The technique for field studies was mainly that adopted in the Cumbum Valley.

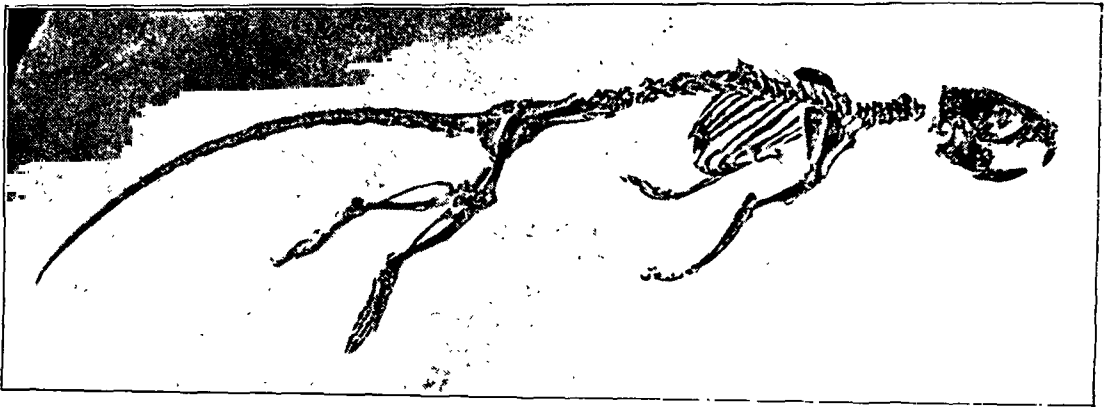
(1) **Rodents and fleas examined.**—One thousand and nineteen rodents comprising 556 house rats (*R. rattus*), 30 bandicoots (*B. malabarica*), 136 mole rats (*Gunomys kok*), 271 house mice (*Mus musculus*), 13 field mice (*Leggāda booduga*), and 13 bush rats (*Golunda ellioti*), were obtained from various parts of the district for purposes of this enquiry. Seventeen musk rats (*P. ceruleus*) were also examined.

From rodents or their nests, 1,939 fleas were collected. These comprise *X. astia* (178), *X. brasiliensis* (514), *X. cheopis* (591), *Ceratophyllus nilgiriensis* (238), *Stivalius* sp. (387), *Leptopsylla musculi* (16), *Ctenocephalus* sp. (1) and *Pulex irritans* (14).

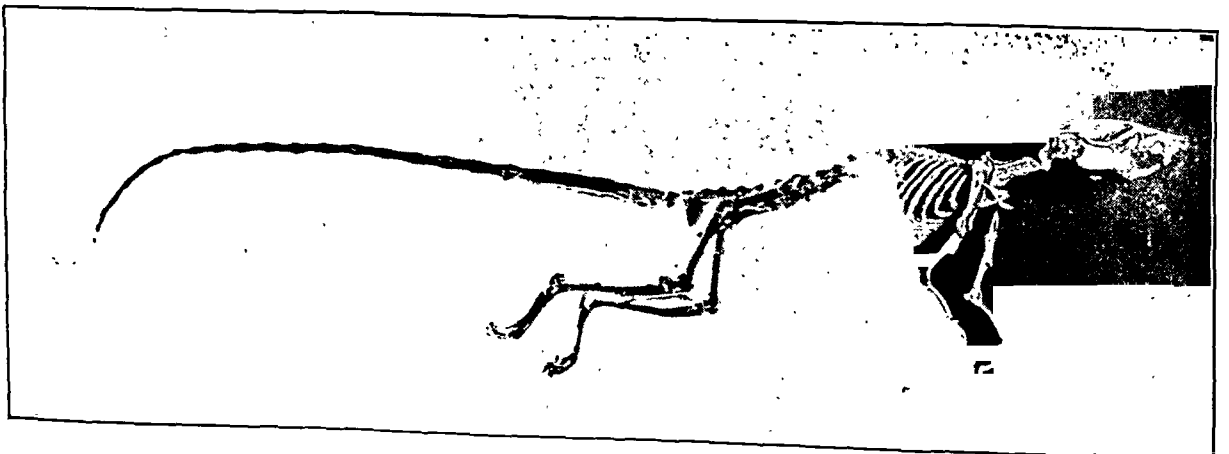
This list is not exhaustive as there are certain other rodents and fleas which were not obtainable. As the material was collected through various agencies, employing different methods, no attempt is made to estimate the species parasitic index of the fleas on the different rodents. It may be said that *R. rattus*, *B. malabarica* and *Gunomys kok* represent respectively the typical domestic, semi-domestic, and field species of rodents essentially concerned in the epidemiology of plague in the Nilgiris. While the rôle of the first two species may not be very different from what it is in the plains, that of the third is not clear, especially as it is found to harbour varieties of fleas not found in the plains.

Short descriptive notes on the important rodents, except the very familiar *R. rattus* and house mouse are given below. These notes, with

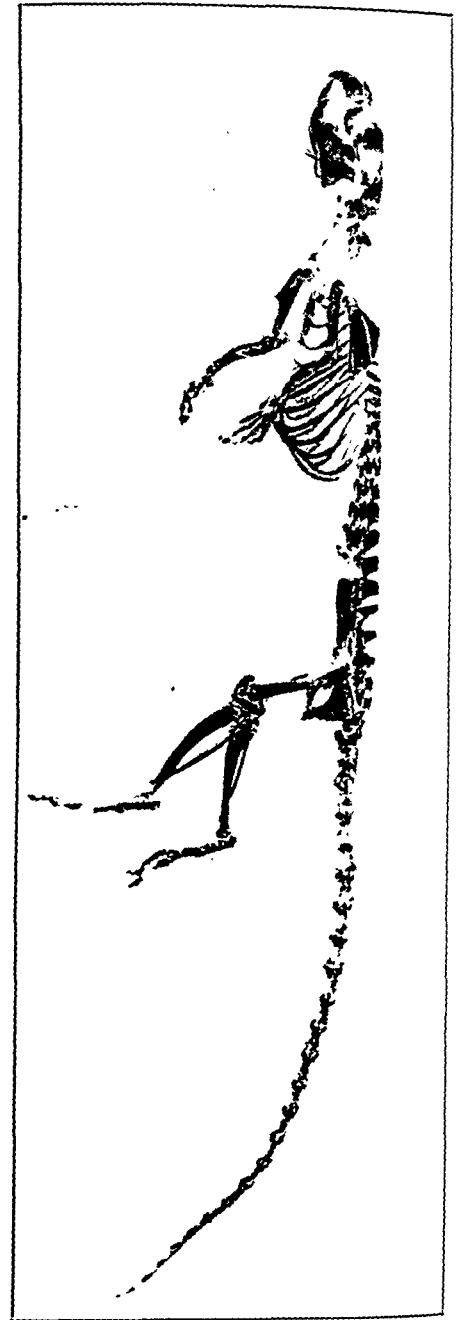
PLATE V



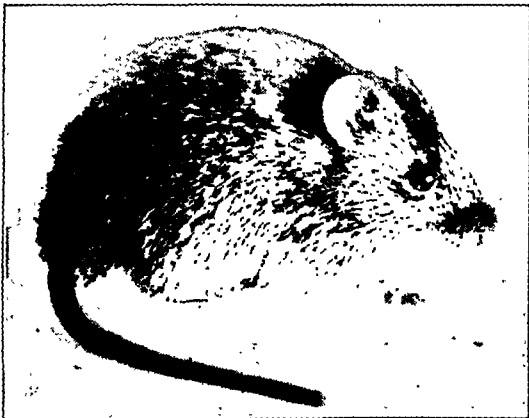
*Gunomys kok.*



*Rattus rattus.*

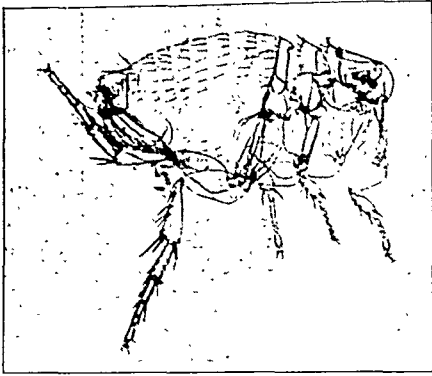


*Bandicota malabarica.*



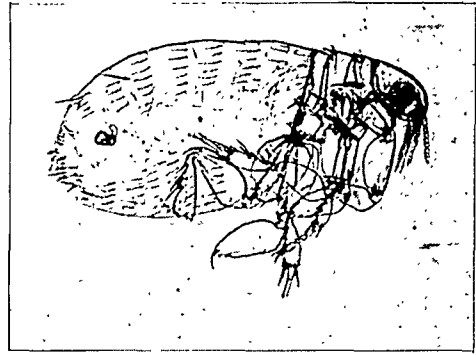
*Golunda ellioti.*

PLATE VII

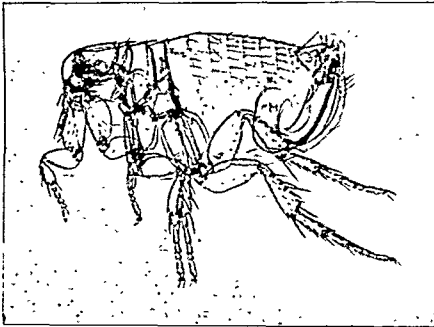


♂

*Xenopsylla brasiliensis.*

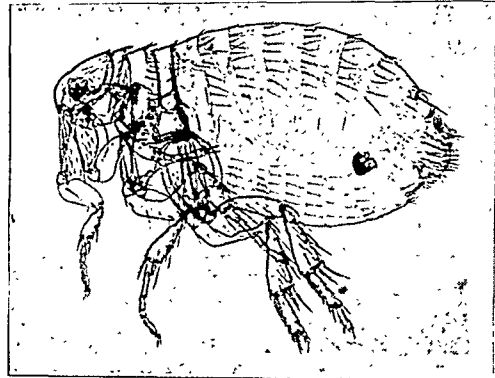


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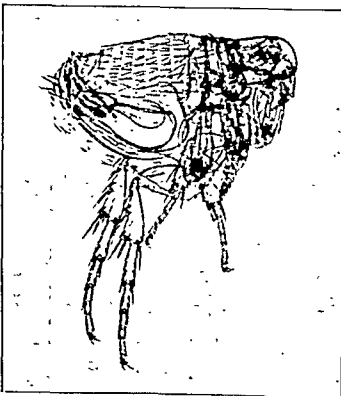


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*Xenopsylla cheopis.*

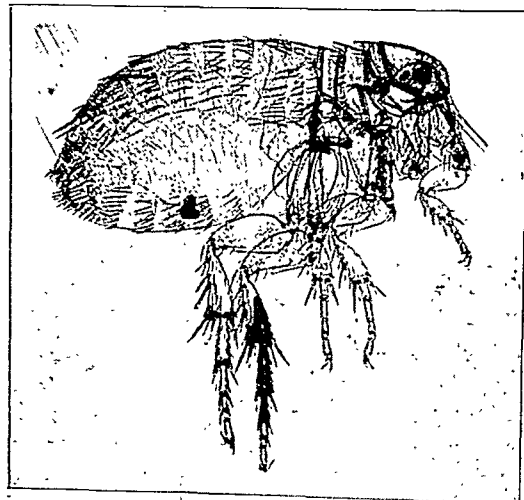


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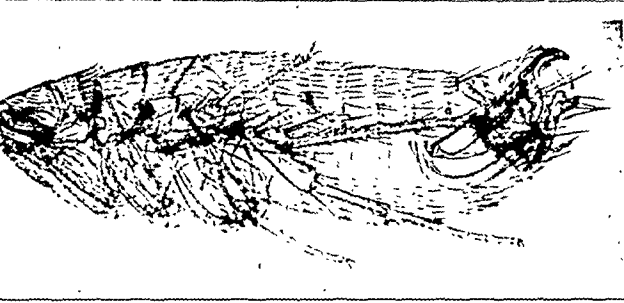


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*Xenopsylla astia.*

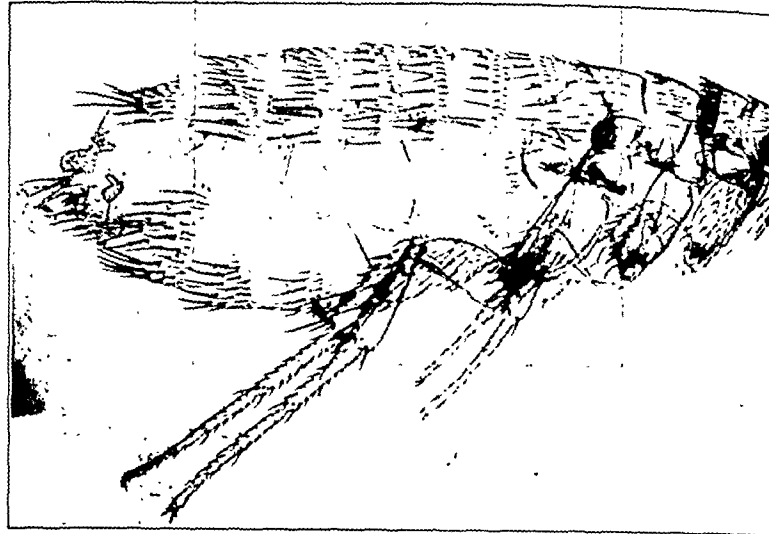


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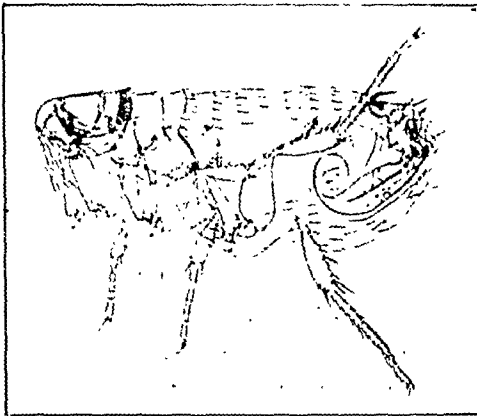


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*Stivalius aporus.*

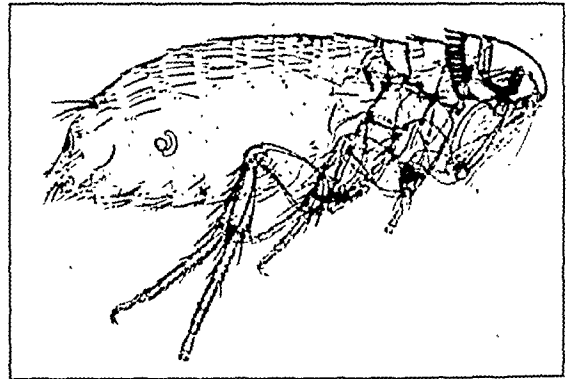


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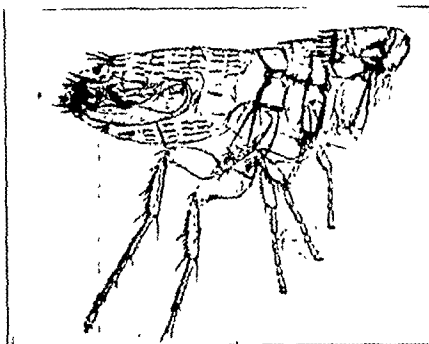


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*Ceratophyllus nilgiriensis.*

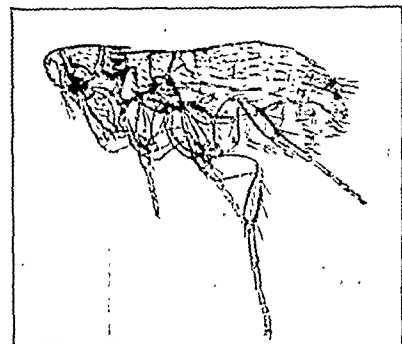


♀



♂

*Leptopsylla musculi.*



♀



the accompanying photographs of the rodents and their skeletons, may be of interest to field workers on plague, *vide* plates V and VI.

Plates VII and VIII show the important features of the fleas referred to in the text, as seen through a hand lens.

**Mole rats (*Gunomys kok* Gray).**—The rodent which abounds largely in the cultivated fields both within and outside the municipal areas of the Nilgiris is the mole rat. One of its favourite habitats in this district is the potato farm, but it also prevails in uncultivated lawns, tea and coffee plantations, fruit gardens, etc. It is easily distinguished from other prevailing species by its big size, only excelled by the bandicoot, broad head, more or less bull-dog-like face due to unduly prominent masseter muscles, coarse dark-brown dorsal coat, short tapering tail with ill-defined annular rings and no tuft of hair at the tip, and, above all, by its characteristic grunt and ferocity. It burrows more deeply and extensively than many other rodents. While in the plains it lives mostly on the bunds of paddy fields and other damp environments, in this hill station it is found all over, even around human habitations. It actually seeks shelter in houses during rainy months, or when food is scarce outside. The burrows of mole rats are extensive with numerous intricate branches most of which are temporarily plugged with earth for protection against enemies. Fumigation of burrows with cyanide products, unless accompanied with necessary exploratory diggings to unplug them, has therefore only a limited success with mole rats, contrary to experience, with most other known plague rodents of South India. The nests of these mole rats usually contain, along with various bedding materials, large quantities of stored food. In the plains, often 4 to 6 lbs. of paddy or other grains are found in each system of burrows during the harvest season. In the nests in potato farms of the Nilgiris a number of potatoes are usually found.

One hundred and thirty-six mole rats and several of their nests were examined for fleas. It is interesting to note that 120 fleas collected from 5 mole rats and their nests at Nanjanad (7,400 feet altitude) were all *Ceratophyllus nilgiriensis*, while out of 230 fleas collected from 60 mole rats from the Pomological gardens in Coonoor (5,730 feet) 199 were *Stivalius* sp., 19 *Ceratophyllus nilgiriensis*, 11 *X. brasiliensis* and 1 *X. cheopis*. A rat flea survey by one of us (P. V. G.) of Ootacamund in 1929 revealed that while *X. cheopis* formed about 50 per cent of the fleas on *R. rattus*, they formed only about 8 per cent of the fleas on *Gunomys kok* within the town. At Coonoor, during the present enquiry, it was found that *X. cheopis* formed only 0.4 per cent of the fleas on mole rats. In the plains, observations in the Cumbum Valley show that mole rats harbour *X. astia* almost to the exclusion of *X. cheopis*. Mole rats have been found quite susceptible to plague, and their rôle in the epidemiology of plague should therefore depend on the vector efficiency of the sort of fleas which parasitize them in the different areas.

**Bandicoots (*B. malabarica*).**—The bandicoot prevails largely in the immediate vicinity of habitations, either in or around house drains, rubbish heaps, cowsheds, etc. It is much bigger than the mole rat or any other South Indian plague rodent. Its head is narrow, contrasting with that of the mole rat. The tail is thick and blunt with well-marked annular rings and in length is only about a tenth shorter than that of the head and body together. Its coat is uniformly harsh with long spinous hair. In its wandering and scavenging habits, no other Indian plague rodent can compare with it except perhaps *Rattus norvegicus* of the seaport towns. Plague epizootics in certain areas are heralded by deaths among bandicoots, followed by rat and mouse falls. From its semi-domestic habitat it may be rightly said to form the intermediary in the extension of plague from house rats to wild rodents. It is also as susceptible to plague as *R. rattus*. In proportion to its size, it harbours large numbers of fleas. At Coonoor, it was found infested with *X. astia*, *X. cheopis*, *X. brasiliensis* and *Ceratophyllus* fleas, the specific flea indices decreasing in the same order. Its *cheopis* index was 1.2 during this enquiry.

**Bush rats (*Golunda* species).**—More than one species of *Golunda* are said to prevail in the Nilgiris, but all the specimens we got, except one not yet identified, were *Golunda ellioti*. In this hill station, the bush rat is found to harbour very few fleas. When present, these are either *Ceratophyllus* or *Stivalius*. On the other hand, in the Cumbum Valley these rodents are found to harbour only *X. astia* and no *X. cheopis*. The bush rat is easily identified by its flat ears, longitudinally grooved incisor teeth and the characteristic yellowish brown coat. It is a poor burrower, the nest, generally composed of coarse grass, leaves and small twigs, being usually found in shallow pits or in discarded burrows of other rodents. Its favourite habitat is under cover of thick hedge growths on the edges of cultivated fields where its characteristic runs can easily be recognized. As it usually confines itself to its own trodden path, it is easily led into traps laid along the runs. Though it is susceptible to plague, it may be said to possess only a negligible rôle as a reservoir of plague as it harbours few fleas and seldom *X. cheopis*.

**Field mice (*Leggada booduga* Gray).**—The field mouse prevails largely in cultivated fields and lawns. It is easily recognized from the house mouse by its smaller size and yellowish brown dorsal and white ventral coat. Although it is quite susceptible to plague, its rôle in the spread of plague is negligible since it carries very few fleas.

**Flea counts.**—The following table (I) gives the percentages of various fleas found on *R. rattus*, *B. malabarica* and *Gunomys kok* during the present enquiry as compared with those from a survey carried out by one of us (P. V. G.) in 1929.

TABLE I

Place	Rodents	Number of		Percentage of different flea species					
		Rodents	Fleas	X. a.	X. b.	X. c.	C. n.	Stiv.	L. m.
Coonoor (1939)	<i>R. rattus</i>	243	1,038	8.7	37.9	40.5	3.5	0.2	1.2
	<i>B. malabarica</i>	12	81	74.1	7.4	14.8	2.5	..	..
	<i>Gunomys kok</i>	81	269	1.5	5.6	0.4	9.2	84.4	..
Ootacamund (1929)	<i>R. rattus</i>	77	276	9.7	14.5	49.0	22.6	..	3.7
	<i>Gunomys kok</i>	8	24	..	8.3	8.3	83.3	..	..

X. a. = *Xenopsylla astia*.  
X. b. = " *brasiliensis*.  
X. c. = " *cheopis*.

C. n. = *Ceratophyllus nilgiriensis*.  
Stiv. = *Stivalius* sp.  
L. m. = *Leptopsylla musculi*.

The above table clearly shows that the predominating flea on *Gunomys* in Coonoor is *Stivalius* and in Ootacamund, *Ceratophyllus*. The flea which predominates on the bandicoot is *X. astia*, though *X. cheopis* also are largely present. On *R. rattus*, which is primarily concerned with epidemic plague, the flea which predominates in both towns is *X. cheopis* and next in order *Ceratophyllus* in Ootacamund and *X. brasiliensis* in Coonoor. Expressed more scientifically, the cheopis index of *R. rattus* (average number of cheopis per rat) for Coonoor (1939) was 1.73 and for Ootacamund (1929) it was 1.75. This evidence of parasitology may alone explain the endemicity of plague in the Nilgiris district. Thus, Hirst (1927) states that a cheopis index of one associated with moderate density of rat population would indicate potential danger of plague epizootics.

**Examination of rodents and fleas.**—All rodents obtained were carefully autopsied and those with suspicious signs were studied by cultural methods, animal inoculation, smear examination, etc. Three carcasses of *R. rattus* examined from Iduhatty village proved positive to plague. One hundred and twenty live fleas were collected from these specimens and plague infection proved in them. About half the number of these infected fleas were examined alive in capillary tubes. One of those (*X. brasiliensis*) which suggested infection from the blocked condition of its proventriculus was fed on a white mouse. The mouse contracted infection from this bite and succumbed on the 8th day with signs of acute plague, later confirmed by animal passage. No definite positive signs of plague were noted in any of the other rodents or fleas examined. It may be noted that they were mostly collected from areas where there has been no recent infection.

(2) *Plague transmission experiment with Stivalius and Ceratophyllus fleas.*—*Stivalius* fleas are plentiful in the Nilgiris, especially in and around Coonoor. They appear to become fewer as the altitude increases beyond Coonoor. Three sub-species of this flea, *Stivalius ahalæ*, *Stivalius aporus* and *Stivalius ferinus*, have been described by Jordan and Rothschild from the Nilgiris. The similarity between these sub-species is rather close, and while the sorting of killed, cleared, and mounted specimens is not difficult, the sorting of live ones requires considerable experience. Ordinarily for biological transmission experiments one should work with each sub-species separately. In the present work, however, for want of sufficient time in rearing individual species of fleas in artificial nurseries, *Stivalius* fleas collected off *Gunomys kok*, presumably a natural mixture of all the prevailing sub-species, were employed for the transmission experiments. While the results obtained may be deemed to fall short of strict biological accuracy regarding each of the sub-species, they must be true with respect to one or other of all of them, and therefore should satisfy all the requirements for practical application.

Five transmission experiments were carried out—*vide* table II for details. Special transmission cages of the type employed by the Plague Research Commission in India, obtained on loan from the Haffkine Institute, Bombay, were employed. White mice were used as the animal hosts, as these are said to have a uniform susceptibility to plague, and are, further, easy to handle. Every technical precaution was adopted to eliminate the chances of extraneous rats or fleas having access to the transmission cages, or the escape therefrom of infected animals or fleas. For each experiment a white mouse was artificially inoculated by the cutaneous

TABLE II  
Protocol of transmission experiments

Number	White mouse infected	Flea species with number employed	Introduction of fleas on to infected mouse	Death of infected mouse	Introduction of test mouse	Death of test mouse	RESULT OF EXAMINATION OF				
							Mouse			Surviving fleas	
							Post-mortem signs of plague	Smears	Culture	Smears	Culture
1	12-6-39	<i>Stivalius</i> species (14) ..	17-6-39	22-6-39	22-6-39	25-6-39	+	+	Not done.	Not done.	Not done.
2	1-7-39	Do. (20) ..	2-7-39	4-7-39	7-7-39	* 17-7-39	+	+	—	+	—
3	1-7-39	Do. (20) ..	3-7-39	4-7-39	7-7-39	* 17-7-39	+	+	—	+	+
4	1-7-39	<i>Ceratophyllus nilgiriensis</i> (20).	2-7-39	3-7-39	3-7-39	† 6-7-39	—	—	—	Not done	Not done.
5	1-7-39	<i>Ceratophyllus nilgiriensis</i> (20).	3-7-39	4-7-39	7-7-39	12-7-39	—	—	—	+	+

\* Test mouse killed.

† Test mouse died of other causes.

route with a 48-hour broth culture of a recently isolated local strain of plague bacillus. Fleas purposely starved for a few days were introduced when the mouse showed signs of septicæmia preceding its fatal termination. To test the infectivity of these fed fleas, healthy mice were introduced after definite intervals. These test mice and the surviving fleas were tested for evidence of infection, either at the time of death of the mice or when the mice were killed about the time when the enquiry had to be wound up.

In the first experiment, where the fed fleas were put on the test mouse the same day, the latter died of acute plague on the third day. In the second and the third experiments, where the fed fleas were starved for 3 days, before being put on the test mice, the latter when killed showed certain post-mortem signs suggestive of plague and smears from their viscera showed plague bacilli. Pooled emulsion of the surviving fleas in the first experiment was injected into a guinea-pig which on being killed on the 14th day showed certain lesions of resolving plague. Crushed smears of fleas which survived the second and third experiments showed plague bacilli.

Employing similar technique, two experiments were carried out with *Ceratophyllus nilgiriensis*. One experiment had to be discounted as the test mouse died prematurely owing to other causes. In the second experiment, where fed fleas starved for 3 days were put on a test mouse the latter on being killed showed no evident post-mortem signs of plague. Two out of the 3 surviving fleas however showed numerous plague bacilli in their stomachs a week after they were fed on the infective mouse. Cultures from their stomach contents were also positive to plague.

It is clear from these experiments that *Stivalius* fleas can transmit plague at least up to 3 days after feeding on an infected host. If time had permitted the maximum period for which these fleas are capable of retaining infectivity could have been worked out and would have helped comparison. The flea which is infective for the longest period is really the most efficient vector, but such longevity experiments have been carried out only for very few of the known fleas. *X. cheopis* has been shown to remain infective for about a month under semi-natural conditions (George and Webster, *loc. cit.*).

It may also be reasonably concluded that *Ceratophyllus nilgiriensis* is at least a weak vector of plague among rodents inasmuch as they retained live plague bacilli in their stomachs for over a week. Another important point to be considered, in deciding the vector efficiency of these fleas, is whether they readily bite man. As there was plague in the district at the time, we did not experiment with the fleas collected from rats to ascertain this fact. Certain species of *Ceratophyllus* are already known to bite man readily, but we have not come across any authentic record about *Stivalius*. Local

enquiry has not helped us in getting any information on this point, but if these fleas, which are unusually big in size, were really vicious human biters, like *Pulex irritans*, such information would have been readily forthcoming.

It is perhaps appropriate here to mention that another flea which prevails here and which is absent on rats in the plains is *Leptopsylla musculi*. No transmission experiments were done with this flea during this enquiry, but it is already known from Chinese workers that it is a weak vector of plague and that it only reluctantly bites man. The other fleas, *X. astia*, *X. brasiliensis*, *X. cheopis*, *Pulex irritans* and *Ctenocephalus*, most of which have been found to infest the field rodents as well as the domestic rodents of the Nilgiris, require to be discussed in this connection. The first three *Xenopsylla* fleas are all known to be good vectors of plague, the last (*cheopis*) being, of course, the most efficient of all known fleas. *Pulex irritans*, or the human flea, is largely prevalent all over the district to the extent of being a regular scourge. These fleas have been supposed by various workers to be capable of spreading plague, though convincing experimental proof is lacking. The need for their control is therefore to be emphasized, especially during plague epidemics. *Ctenocephalus* fleas are not good vectors of plague among the rodents, as they feed only very reluctantly on hosts other than their specific hosts, dogs, cats, cattle, etc.

*Discussion.*—As pointed out in the earlier part of this report, the usual seasonal variations in the incidence of plague are not evident in the Nilgiris district. The explanation may perhaps be found in a review of the ecology and vector efficiency of the indigenous plague fleas of the district. *X. cheopis*—the tropical plague flea—transmits plague best between 68° and 78°F., and when the saturation deficiency is below 0.3 inch of Hg. It is also known that certain fleas, such as *Ceratophyllus fasciatus*, of temperate climates transmit plague best at temperatures about 10 to 15° lower than the optimum for *X. cheopis*. Therefore, in areas where the biological factors concerned in the spread of plague, both of warm and cold climates, co-exist, it is possible that the infection may be carried over in relays from season to season. Thus the observation of Colonel Russell, *i.e.*, that seasonal variations in the incidence of plague in the Nilgiris is not very evident, may be explained as due to the co-existence and interplay of more than one efficient plague flea.

As examination of wild rodents and their fleas on an adequate scale could not be carried out during the limited period of this enquiry, no definite proof could be adduced either for or against the existence of sylvatic plague in the district. The examination of the small number of specimens collected did not yield any positive results. We are in agreement with K. F. Meyer (1939) that only animal inoculation tests with pooled emulsions of wild rodent fleas on an

extensive scale could clinch the accuracy of the diagnosis of sylvatic plague. The crucial evidence of infection in wild rodents is difficult to obtain as their casualties occur either in their subterranean nests, or, if in the open, they fall a prey to carnivorous animals and birds. The report of Jellison (1939) on predatory and scavenger birds and their nests, offers the possible reason why it should be difficult for workers to detect plague infection in wild rodents during sylvatic plague surveys.

In the Nilgiris, the peculiar configuration of the land, the prevailing climatic conditions, the abundance of a variety of wild rodents and fleas (all complementary hosts and vectors of plague), the common occurrence of human and rodent plague sporadically in areas apparently independent of traffic and the occurrence of pneumonic plague more frequently than in the plains, are features which are in line with those in countries where sylvatic plague has actually been proved to exist. It is, therefore, suggested that sylvatic plague either actually exists now, or the factors are such as may contribute towards its onset at any time.

#### Summary

1. A review of the incidence of human plague in the Nilgiris district from 1903 to 1939 is given. Factors relating to sylvatic plague are also discussed.

2. A limited rodent and flea survey of the district with reference to plague has been carried out. One thousand and nineteen rodents and 1,939 fleas collected, formed the basis of this survey. All the specimens of rodents and fleas except those utilized for special experiments were examined for evidence of plague infection and the results are recorded. Plague infection was noted only in 3 rodents and 120 fleas, but these were collected from an infected area.

3. Transmission experiments with *Stivalius* and *Ceratophyllus* sp. were carried out and their vector-efficiency is discussed. *Stivalius* fleas transmitted plague to a white mouse 3 days after separation from an infected host. *Ceratophyllus nilgiriensis* were found to harbour plague bacilli in their alimentary tract up to 7 days after having fed on an infected host.

**Acknowledgment.**—Our thanks are due to Lieut.-Colonel C. M. Ganapathy, M.C., I.M.S., and Dr. C. G. Pandit, for valuable advice during the enquiry, to Major H. W. Mulligan, I.M.S., for laboratory facilities provided, to Lieut.-Colonel S. S. Sokhey, I.M.S., for the identification of the sub-species of *Stivalius* fleas and for help in the transmission experiments, to Mr. A. J. Acaster, Secretary, United Planters' Association of South India, for help rendered in the collection of material from various estates and to Lieut.-Colonel H. E. Shortt, I.M.S., for valuable suggestions and criticism in the preparation of this paper.

(Continued at foot of next column)

## ON A PLASMODIUM SP. OF THE MALAY CHESTNUT-BELLIED MUNIA [*MUNIA ATRICAPILLA ATRICAPILLA* (VIEILL.)]

By B. M. DAS GUPTA

and

L. B. SIDDON

From the Department of Protozoology, School of Tropical Medicine, Calcutta

(Malaria Transmission Inquiry financed by the Indian Research Fund Association)

**Introduction.**—During the examination of blood films from over 300 birds comprising fowls, a duck, a pigeon and a variety of sparrows and munias, parasitic infections due to a plasmodium were observed in three out of sixty-one specimens of the Malay chestnut-bellied munia [*Munia atricapilla atricapilla* (Vieill.)] examined. The infected birds had been imported and were obtained from dealers. Scott (1927) recorded a parasite of the order *Hamosporidia* in the same host from a bird which had died in the Zoological Society's Gardens in London, but the infection was too scanty to enable him (and Wenyon) to determine whether it was *Plasmodium præcox* or a *haemoproteus*.

**Method of study.**—In the present series of observations the strain was maintained by blood inoculation in the natural host and in the white-throated munia [*Uroloncha malabarica* (Linn.)] when the former was not available in the market. Both are small birds and 1/20 c.cm. of citrated blood was considered a suitable quantity for inoculation, either into the wing vein or intramuscularly into the leg.

Combined Leishman-Giemsa stain was used: prolonged staining was necessary to bring out the characteristic sex differences of the gametocytes.

**Morphology (stained parasites).**—The youngest form is a tiny rounded body consisting chiefly of chromatinic substance (figure 1). Soon a vacuole forms, the cytoplasmic content increases, and the parasite assumes the shape of a stout ring (figure 2). The ring stage, however, appears to be very transient, in that it is scarcely found even in blood showing heavy infections. As growth proceeds, pigment appears in the form of brown-black granules, and the cytoplasm looks spongy (figures 3 and 4). The growing parasite displaces the nucleus of the host cell to one side or more commonly

(Continued from previous column)

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to one pole, or even out of the cell (figures 5, 12 and 14). At the early stage of schizogony the chromatin becomes diffuse and granular (figure 6). Segmentation of the chromatin now takes place. There is an aggregation of pigment granules even at an early stage of schizogony (figure 7) and when the schizonts are fully developed the pigment collects as a single mass usually in the centre of the parasite (figure 8). The mature schizonts are round; the number of merozoites varies from 8 to 22. Schizonts showing 12 merozoites form the majority; those with 22 merozoites are exceedingly rare. Gametocytes are slightly oval or rounded bodies. They have irregularly distributed pigment. In some, the pigment granules are coarse and discrete (figure 13), while in others they are fine and coalesce together to form irregular masses (figure 14). The male gametocyte takes on a faint pinkish tinge; the nucleus is diffuse and stains badly (figure 15). The cytoplasm of the female stains a deep blue colour. The nucleus is more compact and stains more deeply than in the male (figures 13 and 14). In well-stained preparations a small spherical deeply staining body can be made out; this is probably a karyosomal structure.

The gametocytes appear very early in the peripheral blood, even at the earliest stage of the infection. They are always present in the blood even when other phases of the parasite are absent, or present in very scanty numbers.

Multiple infection of corpuscles is not uncommon. As many as four parasites have been found to occur in one corpuscle (figures 5 and 12) in heavy infections. Parasites were very scanty in the birds (*Munia atricapilla*) which showed the natural infection, but often by a series of sub-inoculations into other birds of the same species and into another species of munia (*Uroloncha malabarica*), heavy infection could be produced. In smears taken from a heavily infected bird almost every stage of growth of the parasite has been found. In experimentally infected birds the incubation period is about 10 days. For a week or so the parasite increases in number and thereafter the infection begins to decline. Very scanty infection persists for a long time and eventually it probably dies out altogether. As a rule pathogenicity is slight, and in only two instances of exceptionally heavy infection could the death of the bird be ascribed to harmful effect of the parasite.

**Host relationship.**—The host specificity was tested for nine species of birds (*vide table*).

The following conclusions are drawn from the results:—

- (1) Species of *Uroloncha* are extremely susceptible to the plasmodium of *M. atricapilla*, even more so than its natural host.
- (2) Canaries are slightly susceptible.
- (3) The plasmodium is not inoculable to the Indian house sparrow.
- (4) Java sparrows, the white-eye, and the domestic fowl, ducks and pigeons have been

TABLE

*Showing host specificity of the parasite*

Host	Number inoculated	Number * examined	Number positive
Malay chestnut-bellied munia [ <i>Munia atricapilla atricapilla</i> (Vieill.)].	53	48	15 (21.2%)
Indian white-throated munia [ <i>Uroloncha malabarica</i> (Linn.)].	41	28	26 (92.8%)
Indian spotted munia [ <i>Uroloncha punctulata punctulata</i> (Linn.)].	1	1	1
Common Indian house sparrow.	26	15	0
Canary ..	6	5	2 (40%)
Domestic fowl ..	3	3	0
White-eye [ <i>Zosterops palpebrosa</i> (Temm.)].	6	3	0
Java sparrow [ <i>Oryzivora oryzivora</i> (Linn.)].	1	0	0
Domestic duck ..	1	1	0
Domestic pigeon ..	1	1	0

\* Only birds which survived ten days (the minimum incubation period of the parasite) or longer are included. Controls (*M. atricapilla* or *U. malabarica*) were provided for all species except the white-eye and the domestic duck.

tried as possible hosts, but the observations are too few to draw any conclusion from the negative results with these birds.

The infections produced in canaries were light and never showed an acute stage, nor was any pathogenic effect observed. In one of these birds examined twelve days after inoculation and found positive with a scanty infection, the parasites disappeared from the peripheral blood roughly at a time when a control munia (*U. malabarica*) showed a moderately heavy infection.

**Invertebrate hosts.**—Two batches of *Culex fatigans* and two of *Stegomyia fasciata* were fed on munias showing a large number of gametocytes, but neither oöcysts nor sporozoites developed in 22 *Culex* and 40 *Stegomyia* examined at intervals varying from eight to thirty days after the date of the single blood meal.

**Systematics.**—Giovannola (1934) and Manwell (1938) have classified the avian plasmodia on the bases of the following morphological characters:—

1. Form of the gametocytes
2. Alterations, if any, in the host cell
3. Number of merozoites
4. Character of the pigment of gametocytes
5. Form of the schizonts.

Manwell has also employed a biological criterion, namely, behaviour in the canary.

Morphologically, the plasmodium of the munia is exceedingly similar to *P. praecox*

Gr. & F. : they agree in the form of the gametocytes and of the schizonts, and in both the nucleus of the host cell is frequently expelled. The pigment of the gametocytes of *præcox* is stated to be fine and dot-like (Giovannola, *loc. cit.*; Manwell, *loc. cit.*) and that of the plasmodium of the munia can only be described as varying from fine particles to coarser, discrete granules. Yet this character is not considered of separatory value since size, distribution, and other features of the pigment are known to be highly variable. Moreover, judging from films of *P. præcox* from Madras sparrows, no noteworthy pigmentary differences could be detected. Nor does the number of merozoites in mature schizonts indicate more than that the plasmodium of the munia may be a separate strain of *P. præcox*, for this species is known to consist of at least three strains differing in this character. The German strain produces 16 to 32 merozoites, the American 8 to 15, and Huff (1937) has described and named a third, *P. relictum* (*præcox*) var. *matutinum* from the American robin, which produces 10 to 22 merozoites, and has also striking biological differences from the other strains.

There are, therefore, no morphological characters which would serve to indicate that the plasmodium of the munia cannot be classified under *P. præcox*.

Biologically, however, there are some interesting differences, so far as the available evidence goes. The fact that Calcutta sparrows could not be infected from the munia is very significant. There is a possibility that the local sparrows have acquired immunity to *præcox*. On the other hand, Knowles (1935) reported that he was studying this species in sparrows in Calcutta, using a strain obtained from Kasauli\*.

There are also differences affecting infections in the canary. *P. præcox* has a definite acute stage in this bird, in which the parasite level is high (Manwell, *loc. cit.*), and it is known to be highly pathogenic, though not so var. *matutinum*. The parasite of the munia, on the other hand, only produces infections of very light intensity in the canary which are by no means pathogenic. Whether the latter results are dependent on the quantity and parasite content of the inoculum requires further investigation.

Failure to infect *Culex fatigans* and *Stegomyia fasciata* may also be an expression of separate identity to other strains of *præcox*.

On the available evidence, therefore, it is possible that the plasmodium of the munia represents a separate strain or variety of *P. præcox* (which it is tentatively proposed to name *P. præcox* var. *munia*). Further studies on its biology are undoubtedly necessary to define its exact position.

*Other blood parasites observed during the investigation.*—Infection with hæmoproteus and toxoplasma was observed in *U. malabarica* and the house sparrow respectively. A trypanosome was also found in *U. malabarica* and it is described in a separate communication.

Microfilariae all looking almost alike were present in numbers in the blood of *Munia atricapilla*. The adults were searched for in the tissues and one male specimen was found and identified as *Diplotrichia dubia* by Dr. N. Bhaduri.

### Summary

A strain of *Plasmodium præcox* (*relictum*) Gr. & F. is described from the Malay chestnut-bellied munia [*Munia atricapilla atricapilla* (Vieill.)] which produces 8 to 22 merozoites and appears biologically different from other known strains of the species. It is provisionally named *Plasmodium præcox* var. *munia*.

### Acknowledgments

The authors desire to thank Dr. Baini Prasad, D.Sc., for identification of some of the birds used in this investigation, Lieut.-Colonel H. E. Shortt, C.I.E., and Major H. W. Mulligan for helpful suggestions. Their thanks are also due to the artist, Mr. H. M. Roy, for preparing the excellent coloured drawings.

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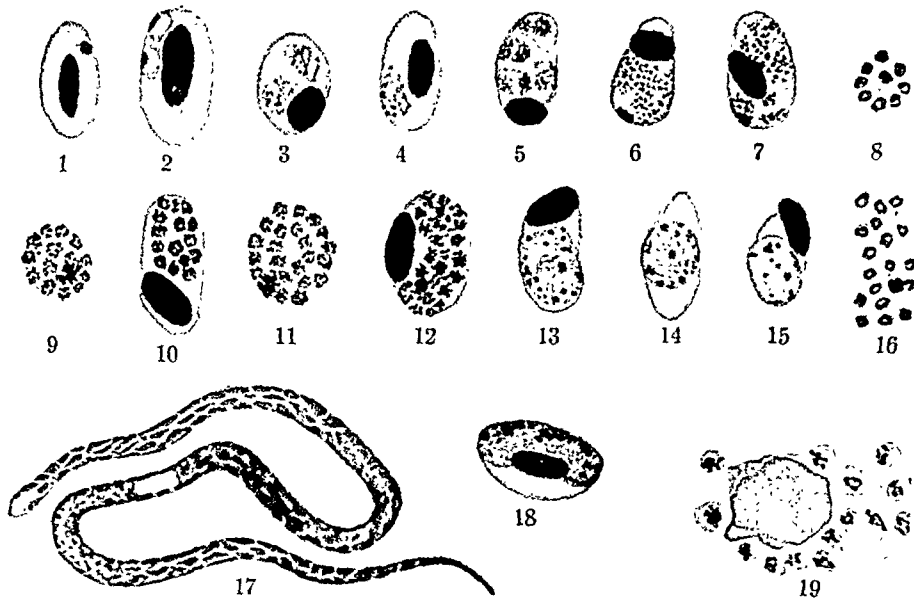
### EXPLANATION OF PLATE IX

- Fig. 1. Very young form.  
 Fig. 2. Two ring forms in the same corpuscle.  
 Figs. 3 and 4. Growing trophozoites showing spongy appearance of the cytoplasm.  
 Figs. 2, 3, 5 and 12 show multiple infection of corpuscles.  
 Fig. 6. Pre-schizogonic stage.  
 Fig. 7. Early schizont.  
 Figs. 8 to 11. Mature schizonts. In figures 8, 9 and 11 the host cells have been destroyed.  
 Figs. 13 and 14. Macrogametocytes. In figure 14 the host cell nucleus has been expelled.  
 Fig. 15. Microgametocyte.  
 Fig. 16. Ruptured schizont.  
 Fig. 17. Microfilaria from the blood of *Munia atricapilla*.  
 Fig. 18. Gametocyte of a hæmoproteus from *Uroloncha malabarica*.  
 Fig. 19. A group of spores of *Toxoplasma* round the host cell nucleus, occurring in blood of the house sparrow.  
 Figs. 20 to 22. Photomicrographs of fully developed schizonts with a varying number of merozoites.  
 (Figs. 1 to 16, 18 and 19 were drawn with the aid of a camera lucida at a magnification of about 1300. Fig. 17 was drawn at a much lower magnification.)

\* Since this report went to press it has been confirmed that Calcutta sparrows are susceptible to a strain of *P. præcox*, obtained through the kindness of Colonel Shortt, from Madras sparrows.

PLATE IX

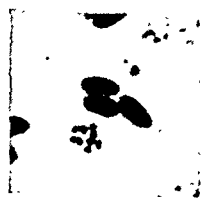
*PLASMODIUM* OF THE MALAY CHESTNUT-BELLIED MUNIA (DAS GUPTA AND SIDDONS)



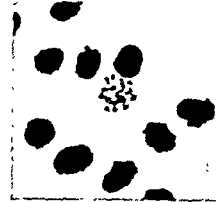
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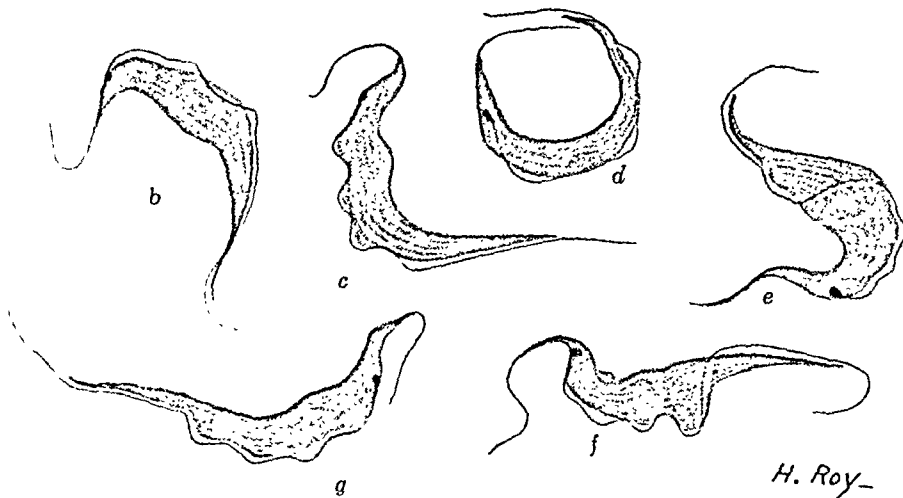
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*H. Roy-*

TRYPANOSOME OF THE WHITE-THROATED MUNIA (DAS GUPTA AND SIDDONS)





# ON A TRYPANOSOME OF THE WHITE-THROATED MUNIA—*UROLONCHA MALABARICA* (LINN.)

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and  
L. B. SIDDONS

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(Malaria Transmission Inquiry financed by the Indian Research Fund Association)

IN connection with our studies on bird malaria 41 specimens of this species of bird amongst others have been examined.

This bird is found practically all over India and in the dry maritime parts of Ceylon. It ascends the Himalayas up to about 6,000 feet, below Simla. To the east, it occurs in Eastern Bengal, but apparently not in Assam, or in the Bengal districts north and east of the Bay of Bengal. On the west, it is found in Baluchistan and Afghanistan, and up to the Arabian coast.

Only two specimens showed scanty infection with the trypanosome. Four birds of the same species were inoculated into the muscles of the leg with the infected blood. These inoculated birds were examined daily from the fourth day onwards. On the tenth day, extremely scanty trypanosomes were found in one of them. It was necessary to examine several smears before a single flagellate was detected. From this time it was noted that although the parasite count was never high it showed marked fluctuation. For example, on one occasion only one trypanosome was found after a very careful examination of three fresh coverslip preparations, but two days later about half a dozen flagellates were found in a single smear. The trypanosomes persisted in the blood of both naturally and experimentally infected birds for more than two months till the birds died. This parasite does not seem to produce any pathogenic effect on the host. The death of the infected birds was probably caused by repeated bleeding for preparing smears and for cultural purposes.

The infected blood was inoculated into N.N.N. medium and incubated for weeks at 18° to 20°C. No growth was obtained in any of the six tubes used.

**Description of the flagellate.**—When examined in the living state under a coverslip the trypanosome is seen to move with moderate rapidity. The undulating membrane is in constant motion and the free flagellum lashes about vigorously. A thin flagellum-like structure is found at the posterior end of the body, which exhibits slow lateral movements.

The dimensions of the trypanosome based on the measurement of forty individuals are as follows :—

TABLE I

Length of body without flagellum	..	36.75µ–52.25µ
Free flagellum	..	7.50µ–10.75µ
Breadth of body at the widest part	..	5.50µ–8.75µ
Distance from kinetoplast to the centre of nucleus.	..	7.75µ–10.75µ

Measurements of the flagellate were taken from blood smears, which were exposed to osmic acid vapour for 30 seconds and then immersed in a jar of absolute alcohol for 10 minutes. These smears were very thoroughly washed with distilled water and stained by Giemsa's stain for an hour. The following method as advocated by Knowles (1928) was employed for measurement of the trypanosome :—

With the 1/12th inch oil-immersion lens, a no. 8 ocular and a reflecting prism, the trypanosomes are projected on to a sheet of paper. Their outlines are drawn, the parabasals and the nuclei indicated. The stage micrometer is then projected on the same sheet of paper and drawn on it. With a scale the divisions corresponding to 10µ are divided into tenths, i.e., 1µ. A line is drawn through the middle of the length of each flagellate and the length of the body, the length of the free portion of the flagellum and the maximal width, etc., are measured with a divider set at 1µ or 2µ.

With regard to general morphology, this is a monomorphic trypanosome. The nucleus is situated about the middle of the body near the convex margin, sometimes occupying nearly the entire depth of the organism (*vide* plate IX, e and f). The kinetoplast also lies near the convex edge at some distance from the posterior end. The undulating membrane is well developed. The axoneme is extended well beyond the anterior extremity as a free flagellum. There are distinct striations on the surface of the body and they extend throughout the entire length. The most striking feature of this flagellate is that its posterior end is prolonged into a long thin caudal process which is of about the same length as the free flagellum; it is even longer in some cases.

It appears from the literature at our disposal that the only avian trypanosome which shows some resemblance to this is a trypanosome described by Hanna (1903) from the blood of the domestic pigeon in India, and named *T. hannai* by Pittaluga (Wenyon, 1926). For comparison, the measurement of different parts of the body and other important morphological characters of the trypanosome of the pigeon and that of the flagellate under discussion are given in table II :—

TABLE II

	TRYPANOSOMES	
	Trypanosome of the white-throated munia	<i>Trypanosoma hannai</i>
Total length	44–63µ	45–60µ
Breadth at the level of the nucleus.	5–8µ	6–8µ
Distance of the kinetoplast from the anterior end.	25–34µ	29–36.5µ
Distance of the kinetoplast from the posterior extremity.	* 12–18µ	19–22µ

\* Represents the measurement from the tip of the caudal process to the kinetoplast.

TABLE II—*concl'd.*

	TRYPANOSOMES	
	Trypanosome of the white-throated munia	<i>Trypanosoma hannaï</i>
Length of the free flagellum.	7-11 $\mu$	6-8 $\mu$
Distance of the kinetoplast from the centre of the nucleus.	8-11 $\mu$	4-6.5 $\mu$
Other characters—		

*Trypanosome of munia*.—The posterior end is prolonged into a long thin caudal process which is of about the same length as the free flagellum or even longer. There are marked longitudinal striations on the surface of the body.

*Trypanosoma hannaï*.—Scattered through its substance, especially towards each end, are granules of a dark violet colour. The anterior end of the body is much elongated, pointed and gradually merges into the flagellum, so that it is difficult to say where the body ends and the free portion of the flagellum begins. At the posterior end the body also tapers and ends in a pointed extremity; in some forms distinct evidence of longitudinal striation is observable.

As shown in table II the chief points which distinguish the trypanosome of the white-throated munia from that of the pigeon are the possession of a long caudal process by the former and marked disagreement in the distance of the kinetoplast from the posterior end of the body and from the centre of the nucleus. Besides, the trypanosome of the pigeon is conspicuous by the presence of deep staining granules scattered throughout the cytoplasm, especially at the ends. The trypanosome of the white-throated munia seems, therefore, to represent a new species and the name *Trypanosoma knowlesi* is proposed in honour of the late Lieut.-Colonel R. Knowles, I.M.S.

#### Summary

A new species of trypanosome (*Trypanosoma knowlesi*) is described from the blood of a white-throated munia (*Uroloncha malabarica*).

#### Acknowledgment

Our grateful thanks are due to Dr. Baini Prasad, D.Sc., for specific identification of the munia referred to in this paper.

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#### EXPLANATION OF PLATE IX

Fig. a is a photomicrograph of the trypanosome. Figs. b to g were drawn with the aid of a camera lucida at a magnification of  $\times 1,300$  from preparations stained with Giemsa's stain.

## DIPHTHERIA: DIFFICULTIES IN THE MORPHOLOGICAL DIAGNOSIS OF *CORYNEBACTERIUM DIPHTHERIÆ*

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ALTHOUGH it is well known that at times it is extremely difficult to decide whether an organism seen in a film belongs to the genus *Corynebacterium*, this fact is often forgotten particularly by those laboratory workers who are but rarely called upon to examine a culture for *Corynebacterium diphtheriæ*. The following experiment illustrates this well.

A throat swab was taken from a child suffering from sore throat and fever. The swab had been taken more for the purpose of excluding diphtheria than on any clinical indications.

A cultural examination was made and the next morning a report was sent to the effect that *C. diphtheriæ* had been isolated. The child who had no complaints and appeared perfectly well when the report was received was given 16,000 units of diphtheria antitoxin. At the same time swabs were taken from the child again and from the immediate contacts in the household—a total of eight swabs. Inoculations were made on Loeffler's medium and also a subculture of the growth on Loeffler's medium inoculated with the first swab from the patient. Smears were made next morning from the growth on the eight tubes of Loeffler's medium. These were stained with Ponder's stain and these eight preparations were submitted in turn to seven bacteriologists all of whom had had more than ten years' experience in diagnostic laboratories.

Two of the seven workers reported that they found no organisms suggestive of *C. diphtheriæ* in any of the eight smears. It may be noted that these two workers had had more experience in handling suspected diphtheria material than any of the others. The other five reports are summarized below.

Subsequently careful and exhaustive examinations were made of the eight cultures and in none of them was *C. diphtheriæ* isolated. Virulence tests (both the intracutaneous and subcutaneous tests) were made with the original culture which had been reported as positive and with cultures from subsequent swabs from the patient. All these tests gave negative results.

These results are recorded to stress the difficulties in the laboratory diagnosis of diphtheria and to indicate the advisability of a central diphtheria laboratory to which all doubtful

(Continued at foot of opposite page)

# THE STERILITY AND POTENCY OF INJECTABLE SUBSTANCES

## (2) GLUCOSE SOLUTIONS

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FOURTEEN samples of commercial preparations of glucose for intravenous use were examined for sterility and strength of glucose present. Original packages of each product were bought in the open market. Standard methods of examination were used and these need not be detailed here.

Except for one ampoule which had an obvious growth of fungi and which was not further examined, all the 72 ampoules tested were sterile (test cultures incubated both aerobically and anaerobically). The results summarized below are the average of the examination of three ampoules of each product. There was no appreciable difference in the results obtained with different ampoules, provided the ampoules were of the same batch number. In two products ampoules with different batch numbers were included in the same outer packing.

(Continued from previous page)

specimens can be submitted for confirmation of diagnosis. These results also stress the importance of evaluating technical procedures and that the evaluation depends on the amount of experience a laboratory worker has had with certain given methods.

Results of the morphological examination by seven bacteriologists of films from Loeffler culture of swabs from a case of sore throat and from six contacts of this case

Swabs from	BACTERIOLOGISTS				
	1	2	3	4	5
Case (1st swab)	+	0	0	0	+
Case (2nd swab)	+	0	0	0	0
Contact No. 1	0	+	0	0	0
Contact No. 2	0	0	0	0	0
Contact No. 3	0	0	+	0	0
Contact No. 4	0	0	+	+	+
Contact No. 5	0	0	+	+	0
Contact No. 6	0	0	+	+	0

+ = when the report stated that *C. diphtheriae* were seen.

+ (?) = when there was no definite conclusion made but the report stated that 'bacilli with metachromatic granules or bars seen arranged in a manner suggestive of *C. diphtheriae*'.

In order to avoid any personal bias the contents of three ampoules of each preparation were placed in separate tubes and the tubes given serial numbers and so arranged that it was not possible to identify the products of any company whilst the estimations were being made. The analysis was made after all the tests were completed.

Results of the examination of fourteen samples of commercial glucose solutions for intravenous use

Number	pH of the solution	Percentage of glucose claimed	Percentage of glucose found	Percentage of glucose found to the amount claimed
1	3.8	25.0	15.4	61.6
2	5.3	25.0	22.5	90.0
3	3.9	25.0	22.9	91.6
4	5.1	25.0	23.8	95.2
5	4.4	25.0	24.9	99.6
6	4.4	25.0	24.9	99.6
7	4.3	25.0	24.9	99.6
8	4.9	25.0	25.1	100.4
9	4.1	25.0	25.2	100.8
10	5.0	25.0	25.3	101.2
11	4.2	25.0	25.3	101.2
12	4.4	25.0	26.2	104.8
13	4.5	12.5	13.1	104.8
14	4.9	50.0	49.8	99.6

From the tabulated results it will be seen that:—

(1) One product (no. 1 in the table) is unsatisfactory. Whereas it was claimed to contain 25 per cent glucose it was found to have 15.4 per cent or only 61.6 per cent of the glucose that the ampoules were labelled to contain. Further ampoules of this particular sample were examined with similar results.

(2) Three products (nos. 2, 3 and 4 in the table) also contained less glucose than the amount claimed. These three samples contained 90.0, 91.6 and 95.2 per cent of the amount that they should have contained. Control experiments with glucose solutions of known strength showed that the experimental error in the estimations was less than  $\pm 1$  per cent.

(3) The remaining ten products were satisfactory. These were all preparations of commercial firms of established reputation and the results show that two of the samples contain a little more glucose than the ampoules were labelled to contain.

An attempt was made to correlate the reaction of the solution with the quality of the glass ampoules used by the different manufacturers. The ampoules after thorough washing were tested according to the standards laid down in the British Pharmacopoeia. The majority of the manufacturers used good quality neutral glass, in two products the glass ampoules were of inferior quality alkaline glass and in one box there were four ampoules of

(Continued at foot of next page)

## THE USE OF BACTERIOPHAGE FOR FREEING PROTOZOAL CULTURES OF CONTAMINATING BACTERIA

(ISOLATION OF *Leptospira icterohæmorrhagiae* FROM A MIXED INFECTION IN GUINEA-PIGS)

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and

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CULTURES of leptospira are liable to contamination with bacteria when passaged through guinea-pigs and are often lost when the contaminants are organisms pathogenic to those animals.

Recently, our advice and help was sought for the purification of a strain of *Leptospira icterohæmorrhagiae* which was isolated from the urine of a patient by injecting a young guinea-pig, but which had become contaminated during subsequent passage through another such animal. Among other measures, it was decided to adopt the following two procedures to obtain a pure culture of the leptospira :—

(a) By filtration through L<sub>2</sub> Pasteur-Chamberland filtering candles.

(b) By treating the material containing the two organisms with bacteriophage active against the bacterial contaminant.

We undertook to carry out the latter procedure.

The contaminating bacteria were isolated by plating on agar and identified as belonging to the salmonella group. They fermented glucose, mannite, maltose, arabinose and dulcitol with the production of acid and gas; lactose, saccharose, and salicin were not affected. Litmus milk became strongly alkaline; the methyl red test was positive and Voges-Proskauer reaction negative; indole was not produced and the

(Continued from previous page)

neutral glass and two ampoules of obviously inferior quality alkaline glass. It was not possible to correlate the reaction of the solution with the quality of the glass.

### Summary

The results of the examination of fourteen samples of glucose solutions for intravenous use are recorded. One of the products contained 15.4 per cent glucose, whereas it was claimed to contain 25 per cent glucose. This sample contained only 61.6 per cent of the glucose that the ampoule was labelled to contain. Three other products contained 90.0, 91.6 and 95.2 per cent of glucose claimed. The rest of the samples were satisfactory.

These results stress the necessity of careful supervision during manufacture and the need of some central control of glucose solutions—one of the commonly used therapeutic products.

organisms were actively motile. They were agglutinated by *Bact. paratyphoid B* serum (H & O) to full titre. Pure H serum in the specific phase was not available for determining, exactly, the identity of the organisms and the strain was provisionally labelled as *Salmonella typhi murium* (*Bact. artrycke*). On exposure to the action of bacteriophage, the strain was found susceptible to the action of stock bacteriophage which acted on *S. typhi murium* strains. Preliminary study showed that, by subjecting the salmonella strain to the action of this bacteriophage, lysis was complete in four hours and that this lysis was maintained for more than three days. A potent phage, therefore, capable of lysing the contaminating bacterial strain, was now available.

Liver and kidney tissue containing the two organisms was divided into two portions of 2 c.cm. each. To one, 2 c.cm. of the above bacteriophage were added; to the other a like amount of papain-digest broth (which was the medium used for the propagation of the phage) was added. Both portions were kept at room temperature in the dark for five hours, after which 2 c.cm. of each portion were injected, separately, into young guinea-pigs intraperitoneally. The guinea-pig infected with the phage-treated portion died on the fourth day, exhibiting the typical post-mortem appearance of *Leptospira icterohæmorrhagiae* infection. Microscopic examination showed leptospira to be present and *S. typhi murium* were also isolated from the peritoneal fluid and heart's blood of the animal. The control guinea-pig (inoculated with the portion not treated with phage) died on the fifth day exhibiting the same jaundiced appearance. *Leptospira* and *S. typhi murium* were found by examination to be also present. This attempt, therefore, was not successful.

A second attempt was made, but this time the material containing the co-existing strains was first centrifuged to throw down the gross particles of liver and kidney tissue and sand. (Sterile sand was used to help in grinding up the tissues.) The supernatant fluid was divided into two portions and treated as previously, kept at room temperature in the dark for five hours, and inoculated separately into two guinea-pigs.

The animal injected with the phage-treated portion died during the night of the eighth day. There was intense jaundice, petechial hæmorrhages, and *Leptospira icterohæmorrhagiae* were seen by microscopic examination of the peritoneal fluid. They were also present in the liver and kidneys of this animal. No bacteria were seen and broth and agar media inoculated with peritoneal fluid, heart's blood, ground-up liver and kidney material of the animal remained sterile. The control animal died on the seventh day also exhibiting typical signs of *Leptospira icterohæmorrhagiae* infection. *Leptospira* and the co-existing *S. typhi murium* were found to be

present by dark-ground examination and by culture.

Ground-up tissue from the liver and kidneys of the guinea-pig injected with the phage-treated portion was inoculated into a second animal which was killed on the fifth day. Symptoms of intense jaundice had developed and actively motile leptospiræ were again present in the peritoneal fluid in large numbers and again we failed to isolate the *S. typhi murium* strain. Vervoort's medium for the growth of leptospira was not available then, so a third guinea-pig had to be inoculated to keep the strain going. This animal was definitely ill on the third day, jaundice being marked. Peritoneal fluid was removed and examination showed that *Leptospira icterohæmorrhagiæ* were present in large numbers. The animal was killed and blood from the heart was inoculated into agar, broth and Vervoort's medium. The liver and kidneys of this animal were ground up and also inoculated similarly. A good growth of *Leptospira icterohæmorrhagiæ* was obtained in Vervoort's medium while the agar and broth inoculations produced no growth and the medium remained sterile.

Three more experiments were put up; one was a repetition of the first experiment (where the phage was allowed to act on the bacterial strain in the presence of gross organic matter); another was a repeat of the second experiment (in which the gross liver and kidney tissue was removed by centrifugalization) and the last was one in which the gross matter was removed by filtration through kieselguhr-impregnated filter paper. Controls as already described were put up for the first two while that for the third was one in which papain-digest broth was added to the liver and kidney material that had been filtered. In the first experiment of this series both the test and control guinea-pigs developed jaundice and on their death showed the presence of both leptospira and *S. typhi murium*. In the second and third experiments of the series leptospira only were present and were grown in pure culture in Vervoort's medium. Both the control pigs showed the presence of the two co-existing strains.

#### Summary

A strain of leptospira had become contaminated with a salmonella group of organisms during passage through a guinea-pig.

The separation of the mixed infection and the growth of *Leptospira icterohæmorrhagiæ* was effected by exposing the mixture to the action of a potent bacteriophage active against *S. typhi murium* and subsequent inoculation into guinea-pigs.

This action could not be obtained when gross organic tissue, like that obtained by grinding up infected liver and kidney tissue, was present. Removal of the gross matter by filtration

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## NOTES ON COMMON SKIN DISEASES

### I. RINGWORM OF THE FOOT

By L. M. GHOSH, M.B. (Cal.), D.T.M. (L'pool)  
(From the School of Tropical Medicine, Calcutta)

*Synonyms.*—Bengal (Hong Kong, Singapore, etc.) rot, mango-toe, athlete's foot and foot tethers are synonyms for ringworm of the foot.

The disease is caused by a fungus, chiefly the *Epidermophyton floccosum*, and the nidus of infection is usually the feet, between the toes, especially the fourth and fifth toe, and the groin area. From the toes the infection spreads to the other parts of the foot and also to the body. Sometimes the primary site may be the dorsum of the great toe.

For those who are in the habit of wearing socks and shoes for long hours, once the part is affected, it is difficult to get rid of the infection altogether, as heat, moisture and friction favour the growth of the infective organism.

In the first stage the epidermis of the skin becomes whitish, sodden, and peels off easily, then small pits, where the horny layer seems to have been eaten away, appear. If left untreated these may lead to cracks, fissures, and ulcerations. Secondary pyogenic infection at this stage is very common and inflammation of the areolar tissue (cellulitis) is not an uncommon incident.

With the advent of the cold weather, the condition apparently gets better, only to recur in the next hot weather and monsoon months.

The disease may confine itself to the toes, but quite often it extends to the instep and the sole of the feet, and may even spread to the other parts of the body.

After some time, a couple of years or so, the continuous irritation together with the toxins produced by the fungus may give rise to a condition of hypersensitiveness of the skin with the resultant allergic symptoms of various kinds.

A common manifestation is the formation of irritating blisters under the skin of the sole of the feet and palms of the hands, a very distressing condition indeed. Erythematous and papular rashes on the flexors of the elbows and knees, and erythematous scaly eruptions on the body are also seen.

*Prophylaxis.*—1. In the tropics, it is advisable to wear white cotton socks which can be boiled daily.

2. During the bath in the morning and evening, wash the feet well with hot water or

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through kieselguhr paper or by centrifugalization was necessary.

We are grateful to Dr. B. M. Das Gupta who supplied us with the infected liver and kidney tissues.

## VITAMIN A AND CAROTENE RESERVES IN HUMAN LIVERS

By B. AHMAD

and

P. K. SESHAN\*

(From the Department of Biochemistry and Nutrition,  
All-India Institute of Hygiene and Public Health,  
Calcutta)

It is well known that liver is the store-house of vitamin A in the body. Under conditions of vitamin-A sub-nutrition, these reserves are depleted, while, when the food has been rich in vitamin A, a considerable amount of the vitamin is deposited in this organ. Experiments on animals indicate that the liver is capable of storing exceedingly large amounts, even as large as the requirements of an entire life span. The quantity of vitamin A present in the liver may serve as an index of the level of nutrition of an individual with respect to this factor. Though this will be only true under normal conditions of health, as it has been observed that in certain diseases spontaneous excretion of vitamin A may occur leading to depletion of the liver reserves.

\*A worker under the Endowment Fund of the Calcutta School of Tropical Medicine.

(Continued from previous page)

preferably with warm lysol lotion 10 drops to one pint; then wipe them dry with the ordinary methylated spirit and dust them with powder; any ordinary talcum powder will do.

*Treatment.*—Before the ulcerative stage has set in, wash the feet twice daily as above, and then apply one of the following :—

(a)

R.

Acidi salicylici	..	gr. xx
Acidi acetici dil.	..	℥ xxx
Spiritus rectificatum ad	..	℥i

Or (b)

Resorcinol	..	℥i
Tincturam benzoini compositam ad	..	℥i

If the feet are painful and inflamed, apply a hot fomentation with acriflavin (1—5,000), or boric lotion (1—20) during the day, followed by application of a mild antiseptic ointment at night, such as boric ointment, or dilute ammoniated mercury ointment, until the inflammatory condition subsides. At this stage water should be avoided altogether. When the inflammation subsides entirely, 4 per cent gentian-violet lotion made up with 10 per cent alcohol should be applied twice daily, after washing and drying the feet, until the ulcerative lesions are completely healed up. When the ulcers are healed and the parts look healthy, then the salicylic acid with spirit may be applied at night and dusting powder during the day after the bath.

Moore (1937) has studied the vitamin A and carotene content of human livers in health and disease. He observed comparatively high reserve of the vitamin in diabetes and thyroid diseases, and moderate reserves in persons dying as a result of poisoning. While in quite a large number of common diseases low vitamin-A reserves were observed, e.g., pneumonia, septicaemia, heart disease, and nephritis. In liver affections, such as cirrhosis, often no vitamin A was observed in the liver.

Under normal conditions of health the determination of vitamin-A reserves in the liver can constitute an important method of assessing dietary history as well as the state of vitamin-A nutrition of an individual. At the same time it can give us information of the conditions apart from those of deficiency under which vitamin-A reserves might be low. Such information will be useful in practical nutrition as it would indicate higher vitamin-A requirements under the conditions.

No studies on the vitamin-A content of human livers have been reported in India. It is interesting to know the average liver reserves of Indians in health, at different social and economic levels and at the same time, the effects of tropical diseases on the stores present in the liver. With this object in view we started a survey in Calcutta of vitamin-A reserve in human livers obtained from the autopsies of the Calcutta police morgue. In this paper some preliminary observations are recorded.

The vitamin A and carotene content of the livers were examined by the well-known absorption spectrophotographic methods. Vitamin A and carotene enter completely the non-saponifiable portion of the fats contained in the liver and have specific absorption bands, viz, 3280 Å for vitamin A, and 4600 Å for carotene. The livers were obtained immediately after the autopsy. Suitable quantities of it were minced and dissolved by warming up in a small quantity of 10 per cent alcoholic potash. The viscous solution so obtained was repeatedly extracted in cold with ether. The ethereal extract was carefully washed with water and the solvent evaporated off in a current of nitrogen. The solid residue constituting the non-saponifiable portion of the fat was dissolved in a suitable quantity of cyclohexane for spectrographic study. The absorption coefficient of this solution at 3280 Å was measured by photographing the absorption spectrum using a quartz spectrograph fitted with a photometric equipment consisting of Hufner prism, Schiebe cells, rotating sector and a Tungsten steel spark (Zeiss). The coefficient for 1 per cent solution in a 1 cm. column of liquid multiplied by a conversion factor of 53.33 give the vitamin-A contents in micrograms (μg.) per gramme. For the determination of carotene, the absorption coefficient was measured using a visual spectrum step-photometer fitted with a filter transmitting 4600 Å (Pulfrich Zeiss). The absorption co-



efficient of a 1 per cent solution in a 1 cm. column multiplied by a conversion factor of 1200 gives the carotene content in  $\mu\text{g.}$  carotene per gramme.

The following table gives the results of vitamin A and carotene content of 16 samples studied so far. They contain 9 cases of accidents, 3 cases of heart failure, 3 cases of opium poisoning and 1 case of snake bite. Values are tabulated as the content per gramme of fresh liver, as well as the total content of the whole liver. The economic level of the person is

Though the data available is quite inadequate to permit any general conclusions, it is obvious that liver reserves of vitamin A were exceedingly low in these persons when compared to the data obtained in other countries through similar studies. These data are presented to indicate the scope of such studies and the trend of values of vitamin reserves in Indians in health and disease.

The authors desire to thank Major D. Ahmad, Calcutta Police Surgeon, for supplying samples of liver.

TABLE

Number	Description of case	State of nutrition	Cause of death	Age	Total weight of liver (g.)	Non-sap. portion, per cent	Concentration of vitamin A ( $\mu\text{g.}$ per gm.)	Total vitamin A in liver (mg.)	Concentration of carotene ( $\mu\text{g.}$ per gm.)	Total carotene in liver (mg.)
I. HEALTHY CASES										
1	Middle class	Good	Burns	18	820	0.69	27.0	22.15	3.4	2.78
2	" "	"	Acid burns	35	1,885	1.37	22.7	35.98	1.3	2.06
3	Beggar	Poor	Accident	55	1,130	0.58	11.0	12.23	1.0	1.13
4	Coolie	"	Fall	35	1,075	0.50	9.3	10.00	6.6	7.09
5	Shop keeper	Fair	Suicide	25	1,075	0.50	8.5	9.14	1.4	1.50
6	Mechanic	"	Accident	27	1,050	0.50	7.1	7.45	0.5	0.52
7	Coolie	Poor	"	27	1,520	0.54	7.1	10.79	0.3	0.45
8	Durwan	Fair	Suicide	18	1,390	0.56	3.8	5.28	7.9	10.98
9	Labourer	"	Injury	30	1,330	0.36	5.0	6.65	0.3	0.40
II. HEART FAILURE CASES										
10	Rickshaw puller	Poor	Heart	38	1,855	0.50	8.1	15.03	5.0	9.27
11	Lower middle class	Fair	"	65	1,700	0.59	7.6	12.92	0.5	0.55
12	Shop servant	Poor	"	28	2,350	0.60	4.3	10.10	0.5	1.17
III. OPIUM POISONING CASES										
13	Jeweller	Rich	Opium	25	1,245	0.90	58.0	72.21	7.0	8.76
14	Child	Fair	"	3	140	0.60	20.0	2.8	3.7	5.18
15	Beggar	Poor	"	30	1,470	1.41	14.2	20.87	1.0	1.47
IV. SNAKE BITE CASE										
16	Lower middle class	Fair	Snake	18	1,360	0.49	3.0	10.08	0.3	0.41

given as to indicate the type of diet they were likely to have taken.

From this table it will be seen that the vitamin-A values range from 3 to 58  $\mu\text{g.}$  per gramme, and carotene values from 0.3 to 7.9  $\mu\text{g.}$  per gramme of wet liver. For the working class people as shown by this small sample, the average concentration of vitamin A in the liver is between 7 to 10  $\mu\text{g.}$  per gramme. For the middle class people, the concentration is higher—probably in the neighbourhood of 23 to 27  $\mu\text{g.}$  per gramme.

Curiously enough a high concentration was obtained in 3 cases of opium poisoning (over 14  $\mu\text{g.}$  per gramme). In the one case of snake bite the liver contained exceedingly low amounts of vitamin A.

### Summary

The vitamin A and carotene content of the livers of 16 persons obtained from autopsies at the Calcutta police morgue have been studied to investigate the reserves of this vitamin in health and disease. It was observed that the average vitamin-A reserve of Indian working-class people was between 7 to 10  $\mu\text{g.}$  per gramme of liver and for the middle class it was about 25  $\mu\text{g.}$  per gramme of liver. These values are considerably lower than those observed for normal persons in other countries. In all the 3 cases of opium poisoning comparatively high reserves were found.

### REFERENCE

MOORE, T. (1937) ... *Biochem. J.*, **31**, 155.

# A Mirror of Hospital Practice

## AN UNUSUAL CASE OF PROTEINURIA

By M. M. SYDDIQ HUSSAIN, M.B., B.S. (Punjab),  
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Hyderabad (Deccan)*

F. B., a Muslim female, aged 35 years, was brought to me by a medical student for examination of her blood and urine. She said she was now putting on weight but to me she appeared thin and pale. She has had three live births and one abortion. The first and the second children are now 22 and 20 years old respectively; the third was an abortion at the seventh month and the fourth died at the age of 7 years. This happened about 6 years ago. Soon after the death of the last child she began to have irregular and scanty menses, and finally once in every 5 to 6 months. She approached a hakim for treatment. Her urine at this time was perfectly normal looking. Soon after she started the treatment she felt palpitation and giddiness. To use her own words she did not feel very certain about herself. Then she had itching of the hands and feet, followed by boils. The quantity of urine also began to be diminished and it was irritating. Next she went to her son who was also a hakim. He prescribed some other medicine which gave rise to intractable diarrhoea. Three months after she started the latter treatment the urine became milky, more so, if she drank milk and ate more meat. During this period she had an attack of urticaria which disappeared after some medication. Some distant relations of hers whom she used to visit occasionally are suffering from elephantiasis.

She attributed all her troubles to scanty menses and on the advice of somebody she took some vaginal douches and an oily substance was introduced into the vagina after each douche. This did her menses no good but oedema of feet extending up to the knees appeared on both sides. She was then admitted in the Osmania General Hospital where her condition was diagnosed as sprue. She was given liver extracts and a preparation called erythrogen. She improved, and left the hospital, but her symptoms did not abate entirely.

There was no abnormality with her genital organs except slightly retroverted uterus.

Blood report: red cells—3,500,000 per c.mm., white cells—7,000 per c.mm., hæmoglobin—60 per cent, colour index—0.9. No abnormal cells present. Malarial parasites not found. Wassermann reaction—negative.

Catheterized urine report on the 15th of April, 1940: Colour yellowish white; turbid in appearance; specific gravity—1014; reaction acid; albumin—present abundant; pus cells and red cells plenty; casts not found; fat globules not seen. After extraction with ether a yellowish substance was obtained which looked like fat but had no greasy feel and chemical reactions for fat with osmic acid and sudan III were negative. No sugar was detected with Fehling's or Benedict's reagents. Acetic acid did not remove the haziness of the urine, nor did filtration. Urine ceased to be hazy when proteins were removed by heat or by complete saturation with ammonium sulphate. After destructive distillation of urine no volatile fluid was obtained. After the addition of hydrochloric acid and boiling in water-bath for one hour no crystals were obtained.

### Detailed report of the protein present:—

1. Heat test positive, does not clear with acetic acid.
2. Nitric acid test positive, does not clear with acetic acid.
3. Half saturation with ammonium sulphate—precipitate formed.

4. Filtrate after half saturation with ammonium sulphate: Heat test negative; nitric acid test negative. Biuret reaction negative with the above and also after boiling.
5. Biuret reaction positive with urine giving violet colour (not pink). Therefore peptones, proteoses and albumin absent.
6. Urine gave positive reaction for globulin, tyrosin, tryptophane, phenyl alanine, glucosamine, cystein and cystin.
7. Bence-Jones' protein negative.

Quantity of proteins present was 0.6 per cent.

Second examination done on 10th October, 1940: Urine clearer but still milky. Condition same as above except that now both albumin and globulin are present, proportion, albumin 0.45, globulin 0.30 per cent.

Third examination on 9th November: urine clear—specific gravity 1009. Proteins have completely disappeared.

*Discussion.*—In the literature I have come across a condition which is in some aspects similar to the case described above. It is called 'emulsion albuminuria'. I quote below from *Clinical Diagnosis* by L. Napoleon Boston, Director, Clinical Laboratories, Philadelphia.

'Emulsion albuminuria. Under this caption Cramer has described a unique condition of the urine. In this condition the urine is chylous in appearance, but when placed under the microscope its turbidity is found to be due to a peculiar hazing of the entire field caused by innumerable minute globules of fat. When extracted with ether no fat is to be obtained and the osmic acid reaction is negative. After the evaporation of the ethereal solution an almost colourless residue results, which in one instance—Coriat's case—emitted an odour of burned sugar. Fehling's solution gives a doubtful reaction, and Nylander's (bismuth) test is negative. There is no formation of an osazone with phenylhydrazin and sodium acetate. No volatile liquid is obtained by destructive distillation (acrolein test). The milkiness of such urine is changed to a mere opalescence upon the addition of a few drops of acetic acid or of potassium hydrate. Dilution of the urine with several times its own volume of water also causes a mere opalescence.

Urine acidulated with hydrochloric acid and heated upon a water-bath for one hour may deposit a crystalline substance which is probably allantoin. This body appears to be more closely allied to crystalline globulin; the crystals occasionally found in urine containing Bence-Jones' albumose; and also the colloidal solution of metals, where, by electric pulverization of such metals as platinum, silver, and iridium, they become mechanically suspended as fine particles in water or other fluids. The urine partly cleared by dilution or otherwise gives the ordinary reactions for proteids.

Upon boiling, a copious precipitate is obtained; the supernatant liquid first becoming opalescent and eventually clear. Artificial peptic digestion also clears the urine; but it remains milky upon the addition of hydrochloric acid alone.

*Microscopy.*—The sediment of such urine is likely to contain crystals of uric acid, amorphous urates (few), leukocytes, and in one instance pus and a few erythrocytes were found.'

In acute nephritis and in chronic nephritis with waxy degeneration of the kidneys and in some cases of pneumonia globulin is present in the urine more than albumin. I do not know under what pathological condition a pure globulinuria results. The molecule of globulin is bigger than that of albumin, therefore if it were simply an exudation from engorged capillaries as a result of obstruction in the venous circulation one should get both albumin and globulin. In this

case a cystoscopic examination should have been done but it could not be arranged. Since the condition has now completely disappeared we can assume that either this peculiar urinary condition rarely occurs in sprue and has disappeared after this condition was brought under control or it was due to some irritant drugs acting on the capillaries or tubules of the kidneys or capillaries of the bladder inducing this peculiar leakage. The oedema present was of the passive type, bilateral and symmetrical. There is no history of attacks of lymphangitis. Repeated attempts at blood examination for microfilaria have proved negative and now the condition has completely disappeared. The patient has put on weight, and that pale haggard look is gone. Her periods have also become regular. No particular treatment was adopted after she left the hospital.

*Summary.*—A case with irregular menses was treated by hakims. She developed a condition which looked like chyluria. She had diarrhoea which was diagnosed and treated as sprue. She left the hospital much improved. Her urine showed a condition of pure globulinuria associated with other blood proteins except albumin. There was no fat in the urine though it looked milky. All her complaints have disappeared without any treatment after she left the hospital.

[Clinically the patient appears to have had chyluria. When the urine contains only lymph, fatty elements may be absent or present only in very small amounts. The first two urine reports of this case show presence of albumin.—Editor, I.M.G.]

### A CASE OF MALARIAL PSYCHOSIS

By S. K. SARKAR, M.B., B.S.

Assistant Surgeon, B. N. Railway, Dongargarh (C. P.)

ON 25th January, 1940, a young man aged about 16 was brought by his parents to Dongargarh Railway Hospital for treatment. He looked very ill. Temperature was 102°F. He was very restless, and delirious. Skin and tongue were very dry. Teeth had sordes on them. Spleen was enlarged. His bowels had not moved for the last three days and he had not slept at all for the same period. He was completely disoriented about time and place and sometimes could not recognize his parents. The present illness had started on 21st January when he had a slight fever without any ague. The temperature rose and continued without any remission. On 23rd his behaviour became queer. He refused food and drink, became very restless, started talking foolishly to himself, and could not sleep. *Ojhas* (exorcisers of ghosts) tried their hands, but as there was no improvement he was brought to hospital. He had suffered from fever off and on for about two or three months after which he was quite well for about a month and then the present sickness started.

On admission a soap and water enema was given and later on a tepid sponge. Plenty of water to drink was ordered, but as he was non-co-operative it became very difficult for us to make him drink. He was put on glucose drink as much as he wished and plain alkaline mixture. One-fourth grain of morphia was given at night. He was quiet for about an hour after the morphia injection, but restless for the rest of the night. His mutterings continued. On 26th, his condition was about the same. His temperature rose up to 104°F. A blood smear was examined and it revealed a few malignant tertian rings. Quinine bihydrochloride in the

usual dosage was given intramuscularly. Next morning his temperature was 100°F., he looked better and he was more rational. He was put on quinine sulphate mixture (20 grains a day). On 28th his temperature was normal, and he was quite rational. He was given a seven-day course of quinine sulphate by mouth. The fever stopped except for a slight rise on 29th and the peculiar psychosis never returned. It is interesting to note that, when he became rational, he remembered nothing about his illness. He wondered why he had come to the hospital. There was no history of epilepsy or any mental derangement in this boy, and the family history did not reveal anything. This psychosis could not be due to atabrin therapy as he had never taken any.

*Discussion.*—I read about another case reported by Francis (1938) from Burma in which a woman was charged of murdering her husband. Her behaviour was queer and she denied the charges before the police, who thought that she was feigning insanity and accordingly referred her to the medical authorities. The doctor discovered malarial parasites in her finger blood and treated her for malaria. She recovered and her psychosis vanished. In that case too, she did not remember any incident which happened during her mental aberration.

Malarial psychosis is rare, but it is well to keep in mind the possibility in the tropics when one sees a case of sudden behaviour-change in a patient who has suffered from malaria before and whose behaviour was quite normal up to the time of the sudden break-down.

My thanks are due to my chief for permission to report this case.

### REFERENCE

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### CEREBRAL MALARIA—AN AFEBRILE CASE WITH EPILEPTIFORM CONVULSIONS

By JAGADISH C. BHATTACHARJEE, L.M.P.

Darjeeling Himalayan Railway Hospital, Tindharia, Darjeeling

A NEPALI motor driver, aged 38, was driving the car of a gentleman, who was travelling from Siliguri on the morning of 25th November, 1940. After driving 11 miles, the driver suddenly fainted on his seat. He was dropped by the gentleman at this hospital, but he could not give any history of the case except that the person was a resident of Darjeeling and occasionally stayed at Siliguri (a highly endemic malarious place on the foot of the hills) overnight.

The patient was admitted in a state of complete unconsciousness with pupils contracted, reflexes present and equal on both sides, temperature 98°F., pulse 100, respiration 32, stertorous breathing and froth coming out of the mouth. His limbs were flaccid; the spleen and liver were not enlarged. Hardly was our examination over when the patient had an epileptiform fit, characterized by tonic spasm of the muscles with conjugate deviation of the head and eyes to one side, eyes open, pupils dilated, cornea insensitive, upper extremities flexed and adducted, lower extremities extended and face cyanosed. This stage was followed by clonic spasm, and then complete relaxation occurred. The whole seizure lasted for about three minutes.

Similar fits were at first noticed every 10 to 15 minutes, but gradually the interval became more and more prolonged, the last one occurring a few minutes before death.

Examination of the urine showed no abnormality but blood films showed heavy infection with *Plasmodium falciparum* rings. The patient was given an injection of ten grains of quinine hydrochloride in 20 c.cm. of glucose solution with adrenalin intravenously but this had no effect on the patient.

He died of exhaustion about six hours after admission. No measures however could stop the convulsive seizures. Both rectal and axillary temperature remained within normal limits throughout.

Points to note are :—(i) Complete absence of fever though malaria parasites were found in the blood. (ii) Persistent epileptiform convulsions.

I am grateful to Dr. S. K. Biswas, medical officer, D.-H. Railway, for his suggestion in the diagnosis of the case, which was confirmed by blood examination later.

### A CASE OF DUPLICATION OF THE GENITAL TRACT

By S. N. CHATTERJEE, M.B., B.S. (Lko.).

L.M. (Rotunda), L.R.C.S. (Edin.), P.M.S.

Obstetrician and Gynaecologist to Thomason Hospital Medical College, Agra

K., aged 25 years, Hindu, female, was admitted into my wards with the complaints of painful menstruation, dyspareunia and sterility. Her menstrual periods



Fig. 1.—Photograph showing the duplication of the vaginal canal. Speculum has been inserted on either side and a catheter in the urethra.

started at the age of 14 years and since then they were regular with a cycle of 27 to 28 days and a duration of 4 to 5 days. Dysmenorrhœa had been

present all along. She was married at the age of 18 years and had the complaint of severe pain during coitus since the very beginning. She had been leading a normal sexual life but she had not conceived.

On general examination the woman was quite healthy. She had no history of any previous disease and nothing abnormal was detected in any of her systems.

On local examination the vulva was normal. The vaginal canal was situated normally and was quite capacious. Hymen was absent. To the left of this opening at the same level was found another opening which was at first missed as it was more or less hidden from the view due to the fact that both the lateral walls were apposed to each other. The passage of a small-sized speculum on this side was very painful to the patient. It was found that the canal extended right through just parallel to the vaginal canal. The vaginal canals were separated by a septum about



Fig. 2.—Skiagram showing the lipiodol injected into the uterine cavity. The free lipiodol is seen in the peritoneal cavity.

1 inch thick. Further examination revealed that there was a separate cervix with a normal external os on each side; they were quite separate from each other. Uterus by bimanual examination was found to be retroverted and small in size.

The patient was detained in the hospital till her menstrual period came on. She was examined by means of a speculum and she was found to be menstruating from both the sides through the cervical canals.

A lipiodol injection was made on either side through the cervix to find out the actual size and character of the uterine cavity. It was found that the uterus was entirely divided by a thick septum. Lipiodol was found in the peritoneal cavity showing that the fallopian tubes attached to either side were patent.

Duplication of the genital tract due to the non-fusion of the Müllerian ducts is a rare condition and the above case is more or less of the *uterus didelphys* type though two uteri separated by a sulcus could not be made out by bimanual examination.

**Acknowledgment.**—My thanks are due to Dr. (Mrs.) Dorab, M.B., B.S., for the photograph, Dr. S. Dayal, M.B., B.S., Radiologist, for the skiagram, and Lieut.-Colonel J. C. Bharucha, I.M.S., Principal, Medical College, and Major M. R. Sinclair, I.M.S., Superintendent of Hospital, for permission to publish this case.

# Indian Medical Gazette

MARCH

## HOOKWORM INFECTION

HOOKWORM disease is an essentially preventable disease; it is easy to diagnose, easy to cure, and easy to prevent. Yet in India, as well as in many other parts of the world, millions are allowed to suffer from it. One reason for this is that it is not a dramatic and deadly infection like cholera, nor an insidious and deadly one like tuberculosis, but it is none the less a serious debilitating infection that affects whole populations decreasing their working capacity and increasing their susceptibility to other infections over many years. Again, it is not a disease in which a chance infection, by possibly a single organism, sets in train a series of pathological processes that eventually culminate in a serious disturbance in health of short or long duration, but in that the infection—or 'infestation' as some writers prefer to call it to distinguish it from 'infection' where multiplication of the parasite occurs within the host—acts quantitatively and cumulatively, it is more like a slow chemical poison to which the victim must be subjected over a long period of time before the full effect is apparent.

A single pair of hookworms finding their way into the intestine will settle down in the intestinal mucosa, take their negligible ration of blood, and produce a negligible amount of 'toxic' substance; they will live their allotted span of, say, five years, and die, and then their bodies will pass out harmlessly, leaving the host no worse off than when they entered his body. However, what they will have done during their sojourn that is not negligible is to have passed some millions of ova, which, though incapable of harming the host himself at the time, given suitable conditions will develop into an army of larva which, to borrow the technique of the realistic writer, placed end to end would reach from the tea garden in Assam to the company's head office in Leadenhall Street. In actual fact, they will not of course reach anywhere but will remain where they are in the warm damp soil ready to infect the next passer-by.

The individual thus infected with a single pair of worms, or even up to as many as 50 worms, is, in the vast majority of cases, not a medical problem at all, but he is a public health one; he can carry his light load of hookworms without detrimental effect to himself, and, if he is not subjected to further infection, the hookworm load will not increase, but as long as he defæcates indiscriminately in the fields around his house, or where he works, he is scattering infection that will remain a

continuous source of danger to which he and his bare-footed companions will be continually subjected.

Pathogenicity is ultimately a matter of load. It must be granted that there are some subjects who will carry with complete impunity a heavy load of hookworms that would cause serious symptoms in others, and that even a light load may upset a particularly susceptible individual; nevertheless in the long run, where large numbers are concerned—and the hookworm problem only becomes a problem where large numbers are concerned—environmental conditions being equal, the individual with heaviest hookworm load will suffer the worst disabilities, attributable to hookworm infection. Thus, chance infection (using the word to refer to the process of becoming 'infested'), unless this chance infection happens to be a massive one as it has been in rare instances reported in the literature, is unimportant; it is the continuity of the infection and the summation of the infestation that matters.

The hookworm egg develops in the damp soil into a larva and that larva, awaiting its chance (which incidentally is in most circumstances rather less than that the holder of a single ticket has of winning the Derby sweep), settles on and eventually penetrates the skin of a prospective host; after a six-weeks journey through his tissues the larva finds its way into the intestinal canal and becomes a mature worm. There, lying attached to the mucous membrane of her host and sucking his blood, not only to meet her nutritional needs but, wantonly, the female worm passes her eggs, which mixed with the fæces are placed back on the soil wherever the host defæcates; the cycle is thus complete.

This cycle has a number of vulnerable points. The most vulnerable of all is during the egg and larval stages in the soil. In a dry soil, in either a hot or a cold climate, they will not survive for more than a few days, but in a hot damp one they will live for some weeks. It is this fact that determines the varying distribution of hookworm infection in different parts of the country where the habits of the populations are similar. The next two weak points in the cycle are where the ova leave the host and where the larvæ enter again; in the first case, if the eggs are not passed into the soil but into a septic tank they will be destroyed, and, in the second, as larvæ do not migrate any considerable distance, if nobody passes over the spot where the larvæ are waiting, or if feet are protected properly by shoes—ordinarily shoes do not present an impassable barrier—again the cycle will be broken.

The Indian villager usually defæcates in the open ground near his home, in the process he welds both weak points in this cycle, for he scatters the infection on a suitable medium and at the same time becomes further infected himself. On tea estates matters are worse, for

it is common practice for the coolie to defæcate amongst the tea bushes where he or she and the other bare-footed labourers stand for many hours during the day.

At the same time this is a point at which a complete break in the cycle could be effected by the introduction of efficient sanitation, by the provision and the exclusive use of latrines suitable for the particular locality. Once the ova have reached the soil, if nature does not destroy them, man has little chance of doing so; no really successful method of soil sterilization has ever been put into practice. Nor is it a practical measure to attempt to stop infection by the use of shoes. Shoes or boots naturally form some protection, especially in moderately dry weather, but during the rainy season the larvæ will penetrate a comparatively sound pair of boots, even if larvæ-infected mud does not find its way through lace holes.

The last weak point is in the intestinal tracts where the worm can be subjected to the effect of drugs taken by the patient. Attack at this point will only reduce the worm load of the patient temporarily, for, meanwhile, if he is still following his ordinary habits, he will be re-infecting himself all the time. Treatment can only effect a break in the cycle if it is associated with a change of defæcating ground, and if it includes the whole population; even then it would have to be repeated in order to catch the larvæ migrating through the tissues, unless it were done at a time of year when no reinfection was taking place.

It must be apparent that the only really efficient measure for the permanent reduction of hookworm disease is the introduction of a system of satisfactory latrines, and this fact should never be lost sight of by sanitarians and employers of labour. The latrine problem is a difficult one, but a beginning must be made and medical officers responsible for the labour in industrial concerns should do everything to make their employers realize the vital importance of making some sort of beginning in the matter of latrine provision. The Factories Act of 1934 has made it compulsory to supply latrines in factories and this has focussed attention on the subject. The form the latrine should take will be dictated by circumstances. The bored-hole latrine (*I. M. G.*, 70, 391) has the advantage of low cost so that individual or household latrines can be installed; with their obvious advantages over communal latrines which one does not need to be fastidious to appreciate. The bored-hole latrine is not, however, suitable in all circumstances nor for all terrains (*I. M. G.*, 76, 126), and in a recent number another useful form of latrine was described (*I. M. G.*, 75, 677).

The whole crux of the matter is the maintenance of the latrines in a cleanly state. If they are not kept clean they will not be used habitually and further they will attract flies and in themselves become an actual danger.

On the other hand, a clean and efficient sanitary system will solve other more serious medical problems, as well as that of hookworm disease.

*Anthelmintic drugs.*—Millenia-old customs cannot be changed in a day, or even in a year or two, and therefore other methods of controlling hookworm disease must be considered. The alternative is wholesale anthelmintic treatment. As we have indicated above, this deworming has to be very thorough and very complete to effect control of the disease in the whole population, but even with this limitation it is worth attempting, for it will reduce the source of infection which in turn will reduce the chances of re-infection, even if it falls short of achieving a complete disinfestation of the whole population. Further than this, it will confer a considerable benefit on the individuals treated, at the time and for a year or so, until they have again become heavily reinfected.

Twenty-five years ago, the treatment of hookworm infection presented a serious problem; chloroform and thymol, the only specifics, were not very efficient and were extremely expensive. Beta-naphthol was useless in small and dangerous in effective doses. Then oil of chenopodium appeared; it was a more efficient drug and less discriminating, in that it destroyed other helminths, *e.g.*, ascaris, as well as hookworms, but it was variable in its ascaridol content for which constituent it depended both for its efficacy and its toxicity. Oil of chenopodium is now a pharmacopoeial drug, its ascaridol content is standardized, and it has taken its place as a useful anthelmintic. Next carbon tetrachloride ( $\text{CCl}_4$ ) was introduced (1921); this is a drug of undoubted efficacy as an anthelmintic and was used by the Rockefeller workers in extensive hookworm campaigns in the American continent. It was given in hundreds of thousands of cases by some workers without causing any ill-effects, but in the hands of others fatalities were reported. Given in large doses it damages both the liver and the kidneys; on rare occasions the same thing occurs when it is given in therapeutic doses. With a drug of this kind absolute safety is essential, as a few fatalities will ruin a treatment campaign. If out of a thousand coolies receiving carbon tetrachloride one fairly healthy man dies during the night following his treatment, which was intended to cure him of an infection he didn't even know that he was suffering from, it is useless to explain to his friends that at least ten of the 999 other coolies would probably have died of some disease acquired through the debility of hookworm infection, had they not been treated, nor is it any consolation to his relatives to know that the man himself would not have died had he not had a drinking bout the night before. This sort of things happened far too frequently on tea gardens and elsewhere in this country for carbon tetrachloride to be received with any enthusiasm for wholesale treatment, and its use.



was limited to conditions where the patient could be treated in hospital and kept under observation for at least 24 hours, or could otherwise be trusted not to take any alcohol.

Then, in 1925, came the closely related drug tetrachlorethylene ( $C_2Cl_4$ ); no great publicity was given to its début, for meanwhile the attention of the Rockefeller Foundation had been deflected into other channels and the same extensive hookworm campaigns were not being undertaken. It was found that tetrachlorethylene caused no damage to the livers of cats and dogs when administered in large doses even with alcohol (*I. M. G.*, 68, 554). The first clinical trials with this drug did not indicate that it had any special advantages over carbon tetrachloride, but in India the fact that it was a safe drug attracted attention and it has been used very extensively during the last decade (*I. M. G.*, 64, 424; 68, 617; 69, 500; 72, 650; 74, 198; 75, 652).

Meanwhile, further reports have come from America where, though it has been used in hundreds of thousands of cases, only one case of temporary ill-effect has been reported. All these reports indicate that it is at least as good as carbon tetrachloride in its anthelmintic action.

*Thymol*.—A quarter of a century ago thymol held an important place as an anthelmintic, but its numerous disadvantages, the high cost, the difficulty of administration, its toxicity, a subject to which C. A. Lane devotes over seven pages in his book *Hookworm Infection*, and its relative inefficacy necessitated further research for a better anthelmintic. Thymol was first introduced by Bozzolo in 1879, but its principal advocate was Ashford, a great American helminthologist, so great that when other more efficient anthelmintics were introduced he acknowledged the fact; before his death some eight years ago Ashford came into line with nearly all other American helminthologists and admitted the anthelmintic inferiority of thymol compared with oil of chenopodium, carbon tetrachloride and tetrachlorethylene. In this country, thymol was used extensively, particularly by C. A. Lane, up to twenty years ago, but since then it has been displaced by other, more efficient anthelmintics. To all intents and purposes, as a practical anthelmintic for extensive administration to hookworm-infested populations, thymol died twenty years ago, since when from time to time its ghost has flitted, often rather aggressively, through the pages of our invaluable contemporaries the *Lancet* and the *Tropical Diseases Bulletin*. In order to exorcize this ghost, Mapleston and Mukerji undertook an investigation on the comparative anthelmintic properties of thymol and tetrachlorethylene (*I. M. G.*, 75, 193). The results of this trial were entirely convincing; they showed that a single treatment with thymol left behind 38.1 per cent of *Ancylostoma duodenale* and that after a second treatment with thymol 22.1 per

cent of worms still remained to be removed by other drugs. After a single treatment with tetrachlorethylene only 3.8 per cent of worms were left and after a second treatment none. In the case of *Necator americanus*, both drugs were more successful; the first treatment with thymol left 6.8 per cent of the worms and that with tetrachlorethylene less than one per cent. In a single treatment with thymol only one patient in a series of 25 was cured, and in three others the infestation was reduced to a negligible figure; this left 21 requiring further treatment. With a single treatment with tetrachlorethylene, nine were cured and in 13 others the infestation was reduced to a negligible figure; this left only three requiring further treatment.

Perhaps more significant is the fact that 12 patients received three courses of thymol; the first course removed 679 *A. duodenale*, the second 183, and the third 43; as these patients still showed a significant infestation, thymol was superseded with the result that of 108 worms that had survived three courses of thymol 105 were removed in a single treatment with tetrachlorethylene.

The evidence as it stands to-day seems to indicate that tetrachlorethylene, with its copy-book unblotted over a period of more than ten years, is a safer drug than thymol, with its doubtful past record, but we will not press this point; tetrachlorethylene is at least as safe, it is infinitely more efficacious, it is far cheaper, and it is easier to administer. It seems, therefore, to us that it is quite time that the thymol wraith was finally laid.

Thus, if the control of hookworm disease by disinfection of the population is to be attempted, tetrachlorethylene is the most satisfactory single drug. This should be given in doses of 4 c.cm. for adults, with correspondingly small doses for children. It is best administered shaken up in two ounces of saturated solution of sodium sulphate, in a single dose; individual doses must be shaken up separately and taken quickly, as the tetrachlorethylene tends to settle very rapidly. A single treatment will effect the removal of 99 per cent of necators and 96 per cent of ancylostomes; a second treatment, say a month later, is obviously indicated where complete disinfection is the aim, especially if ancylostomes predominate.

*Hookworm anaemia*.—From the public health point of view, that is all that need be done, but from the point of view of the individual the matter should not be left here. The main disabilities that the individual with hookworm infection suffers are a direct result of the anaemia. This anaemia is produced mainly by the slow but steady draining of the blood of the host by the hookworms attached to the intestinal mucosa, with the resulting exhaustion of iron reserves. The anaemia produced is microcytic and hypochromic, and is a true secondary



anæmia; the toxic action of the hookworm metabolites on the hæmopoietic organs is of secondary importance.

On the important subject of the treatment of this anæmia, C. A. Lane in his book *Hookworm Infection* has but two paragraphs, he writes:— 'Anæmia is the main secondary feature requiring treatment and iron is the standby'. So far so good, but he goes on 'Nevertheless so long as infection persists the giving of iron is in general useless; and even after disinfestation the hæmopoietic organs, *particularly the bone marrow*, may be in no position to use the iron which is placed at their disposal until arsenic, organic or inorganic, has been added to the medication'. In our opinion there is not the slightest evidence to support such a statement; it is possible by iron administration alone to bring the hæmoglobin up to a level well within the normal range of the patient's class, even in a very heavily infected patient (*I. M. G.*, 76, 1), and there is no foundation for the suggestion that after the removal of the worms there is any depression of hæmopoietic function, or that if there were arsenic would remove it.

The remaining paragraph is given, without comment, to complete the quotation. 'There is evidence that traces of copper are necessary. It is unknown whether the carbon tetrachloride which accumulates in the bone marrow after treatment by that drug produces lesions which hinder subsequent recovery from anæmia. The occasional likeness of the blood picture of ankylostomiasis to that of pernicious anæmia indicates on general principles the giving of liver or red marrow; which might perhaps also prove useful in anxiety after carbon tetrachloride administration'! Elsewhere, Lane has severely criticized writers who have laid special emphasis on iron administration in hookworm infection. It is no more irrational to treat the anæmia before removing the worms than it is to give symptomatic treatment in any other disease; frequently such treatment is definitely indicated first, to be followed later by the removal of the cause. This is sometimes the case in severe hookworm anæmia, when, for the comfort of the patient, it may be better to give a course of ferrous sulphate before administering the anthelmintic, though the natural sequence is to remove the majority of the worms by one treatment and then to treat the anæmia.

It is, on the other hand, utterly absurd to remove the worms only and allow the patient to linger on for many months in an anæmic state. Indian dietaries are usually poor, if not actually deficient, in available iron and therefore many people live on the border-line of iron starvation. On such a diet, it will be months, possibly even years, before an individual can make good his iron deficiency and build up a reserve, whereas by suitable treatment this can be achieved within a few weeks. In many cases, the disappointments with the immediate results of a hookworm campaign that have been experienced are due

to this simple fact. The propaganda value of curing the anæmia should not be underrated; the immediate improvement in well-being experienced by the patient and the immediate increase in his working capacity will impress the patient and his employer far more than a post-dated promise of such improvement.

The most convenient and cheapest way to administer iron is in the form of ferrous sulphate tablets, nine grains twice daily. Ferrous iron in the form of a mixture is probably more efficacious; ferrous ammonium sulphate made up with glucose will 'keep' for some weeks, and of this mixture a dose containing twenty grains of the iron salt (equivalent to a little under three grains of metallic iron) should be given twice daily.

We will conclude by saying that no hookworm campaign is complete unless a three-point attack is made, the spread of infection curtailed by provision and habitual use of suitable latrines, the disinfestation of the individuals affected by a suitable anthelmintic, preferably tetrachlorethylene, and the anæmia cured by the administration of iron in large doses. The provision of latrines alone, even if they are used exclusively, will only effect appreciable improvement in the course of a few years but the improvement will be permanent. Deworming alone is often disappointing, unless very thoroughly carried out in the whole population, as it takes many months for the blood to improve sufficiently to be reflected in the clinical picture and meanwhile reinfection will be taking place all the time. Administration of iron alone will produce a marked and immediate improvement in health, but this improvement will disappear within a year or so. Thus, the most permanent results will be obtained by the first measure, the most spectacular by the last, whereas in practice the second is the one that is most frequently put into operation.

L. E. N.

## Special Articles

### HÆMATOLOGICAL TECHNIQUE

#### PART IX

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and

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#### (15) Gastric analysis

*Introduction.*—The gastric juice in the normal individual contains hydrochloric acid, free and in the combined state, the enzymes pepsin and rennin, and the 'intrinsic factor of Castle'. Examination of the aspirated gastric juice, primarily for acidity, but also for the presence of the enzymes, and for other normal and abnormal characters, is known as gastric analysis:

We have included gastric analysis in this series on hæmatological technique, because normal hæmopoiesis is to a large extent dependent on normal gastric function, and consequently the knowledge that we obtain from this test is important in both the diagnosis and the treatment of the anæmias.

Achlorhydria or hypochlorhydria are associated with deficient digestion and absorption of a number of food substances. In some cases of microcytic anæmia, achlorhydria is considered to be the main ætiological factor; iron is more easily absorbed from an acid than from an alkaline medium. Free acid is necessary also for ensuring proper peptic digestion (*v.i.*). Further, in the absence of hydrochloric acid, fermenting organisms flourish, causing flatulence, meteorism, and diarrhœa. This mucosal dysfunction leads to a macrocytic anæmia; the anæmia of sprue is often of this type and due to this cause; but neither in sprue nor in nutritional macrocytic anæmia is achlorhydria constant, nor is there any evidence that the 'intrinsic factor' is also absent. Finally, in pernicious anæmia there is complete and constant achylia\*, which is associated with the absence of the 'intrinsic factor', though this latter deficiency cannot be demonstrated directly in the laboratory.

In practically all cases of anæmia associated with achlorhydria or hypochlorhydria, the giving of dilute hydrochloric acid, alone or with pepsin, will be beneficial, and may in fact constitute an important part of the treatment.

**Methods:** Gastric analysis can be done by either of the following methods:—

(i) Single examination: This is an old method and is almost obsolete now. In this method, after complete evacuation of the fast-ing juice, an Ewald meal, consisting of bread and water, is given to the patient and the stomach contents withdrawn again after one hour.

(ii) Fractional analysis of Rehfuß: In this method, after complete evacuation of the fast-ing juice, a suitable test meal is given to the patient; small samples, about 10 c.cm., of the gastric fluid are drawn off every 15 minutes up to 2½ to 3 hours.

Fractional gastric analysis gives valuable information as to the motility and secretory function of the stomach. This method is followed by us in the investigation of all cases of anæmia in the hospital and in many of the cases attending the anæmia outdoor clinic.

\* The following terms are in common use for the different stages of gastric deficiency:—

Achlorhydria	= absence of free hydrochloric acid during an ordinary test meal, but with response to histamine.
Complete achlorhydria	= absence of free acid even after histamine injection.
Achylia	= absence of free acid and the gastric enzymes, even after histamine.

In the course of the fractional gastric analysis, an injection of 0.5 mg. of histamine is given one hour after the test meal to the patients who fail to show any free acid in any of the previous specimens.

#### Apparatus required

- (i) Rehfuß' or Ryle's tube, or any suitable modification (*vide* figure 1). These are hollow tubes made of good rubber. They are about 32 inches long with an internal diameter of about 1/8th inch. One end of the tube is open, while the other, the tip, ends in an olive-shaped bulbous protuberance filled with metal to weight it and keep it rigid. There are holes in the rubber at or near the tip for the passage of the gastric juice

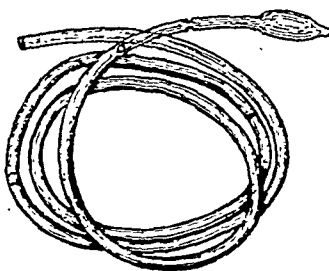


Fig. 1.

through the tube. The distance up to which the tube has to be passed in shown by a mark near the open end, about 20 to 22 inches from the tip.

Before use the tube is sterilized by boiling water, and is kept coiled up in a sterilized petri dish until required.

- (ii) Record syringes 10 c.cm. and 1 c.cm.
- (iii) Twenty-five c.cm. burette graduated in 1/10th of a c.cm., with a stand.
- (iv) Twelve labelled test-tubes in a rack, plus a few extra tubes.
- (v) Capillary pipettes with teats.
- (vi) Small glass funnel.
- (vii) Porcelain dishes—3.
- (viii) Glass rods—3.
- (ix) Centrifuge machine.
- (x) Slides.
- (xi) Microscope.

#### Chemicals required

- (i) One per cent of cocaine, or a suitable substitute.
- (ii) Seven per cent alcohol 100 c.cm.
- (iii) N/10 sodium hydroxide.
- (iv) Dimethyl-amido-azobenzene (0.5 per cent in 95 per cent alcohol (Töpfer's reagent)).
- (v) Phenolphthalein 1 per cent in alcohol.
- (vi) Histamine—0.5 mg. in 0.5 c.cm. sterilized distilled water.
- (vii) Adrenaline chloride solution, 1 in 1,000, for injection.
- (viii) Sulphur powder.
- (ix) Benzidine.
- (x) Glacial acetic acid.
- (xi) Hydrogen peroxide.
- (xii) Pepsin.
- (xiii) Mett's albumin tubes (*v.i.*).
- (xiv) Dilute hydrochloric acid.
- (xv) Fresh milk.
- (xvi) Lugol's iodine solution.

#### Routine procedure

The following is our usual procedure in carrying out a fractional gastric analysis.

##### A. Preparation of the patient

On the previous night, the patient has his usual meal at 8 p.m., and at 10 p.m. he is given 4 charcoal tablets with a glass of milk. The next morning he is not allowed any food or drink before the test is finished. Indian patients

must be warned not to chew any *pan*, as it may impart a red colour, which might be mistaken for blood, to the gastric juice.

Before introducing the tube, in very sensitive patients, the nasal mucous membrane and the posterior part of the pharynx may be sprayed or swabbed with one per cent solution of cocaine, or with a suitable substitute.

### B. Introducing the tube

(i) Through the mouth: With the patient in a comfortable position, sitting if possible, but the test can be done with the patient lying down; the tip of the tube is placed on the posterior portion of the dorsum of the tongue and allowed to drop slowly backwards and downwards. When the tip strikes the posterior pharynx, the patient is instructed to make swallowing movements and the tip will then pass into the œsophagus. The patient should be told to continue to swallow slowly, when the tube will gradually descend until the end has reached the fundus of the stomach; the mark on the tube gives an approximate indication of when this point is reached.

(ii) Introducing through the nose: With a little practice, the introduction of the tube through the nose is much easier than through the mouth and can be carried out even in the most sensitive patient. The tip of the tube is introduced into one of the nasal orifices and gently pushed through the nose until it reaches the posterior wall of the pharynx. The patient is now told to make swallowing movements while the tube is pushed gently down until it reaches the fundus of the stomach.

Some obstruction may be felt in passing the tube through the nose; this is easily overcome by a little manipulation, but if the resistance is great the tube must be taken out and introduced through the other nasal orifice, as not infrequently the septum is deviated to one side.

### C. Drawing out the contents of the fasting stomach

When the tube has been introduced up to the required distance, introduce the nozzle of a 10 c.cm. syringe into the tube, with the piston drawn out; push down the piston so that the air in the syringe is forced through the tube, to dislodge any mucus or food debris that may be blocking it at its distal end; then aspirate the contents of the fasting stomach. If there be any difficulty in getting the juice, vary the position of the tube in the stomach by drawing it out or pushing it in, and/or by forcing more air through the tube.

Rarely, difficulty in obtaining juice may be due to contraction of the gastric muscles, which may be difficult to overcome. An attempt should be made to draw out all the fluid of the fasting stomach by altering the position of the tube in the stomach, by putting the patient in different postures, and by applying a little

pressure to the stomach from outside. The contents of the stomach are placed in the test-tubes previously labelled.

After complete evacuation of the stomach contents the test meal is given to the patients with the tube *in situ*.

### D. Test meals

An ideal test meal is obviously one that bears a close similarity to the ordinary diet of the patient, but, for many reasons, it is not possible to give such a test meal. Various test meals have been advocated, but here we shall describe only two with which we have had personal experience.

(i) Gruel test meal: In making this we have always used Quaker oats, but any form of prepared oats can be used, and in this country some workers prefer to use a rice gruel. Take a tablespoonful of Quaker oats in two pints of water, add a pinch of salt, boil down to a pint, and strain through fine muslin. This meal does not contain any lactic acid and is thus almost an ideal test meal, but, with the tube *in situ*, it becomes very difficult and sometimes impossible to swallow such a large quantity of thick gruel.

(ii) Alcohol test meal: One hundred c.cm. of 7 per cent alcohol is used for this meal. The measured quantity of alcohol is placed in a beaker from which it is drawn up into a syringe and introduced into the stomach through the tube—the process is repeated until the whole amount has been introduced.

This meal is very easy to administer, while the fluid that is subsequently withdrawn is almost clear; this allows of easy titration for acidimetry.

### E. Withdrawal of post-prandial specimen

Note the time when the test meal is given, aspirate with a syringe about 10 c.cm. of gastric contents every 15 minutes up to 2½ or 3 hours. The specimens are kept in labelled test-tubes until the time of examination.

*Histamine*.—As the fasting and post-prandial juices are withdrawn, they are examined for the presence of free hydrochloric acid by the bedside.

Take one c.cm. of the gastric juice in a small test-tube, add a small drop of Töpfer's reagent. Note the colour—red or orange colour indicates the presence of free hydrochloric acid and further bedside examination of subsequent specimens is not necessary.

If free hydrochloric acid is not present in the fasting juice and in the first four post-prandial specimens, an injection of 0.5 mg. of histamine is given and the procedure of withdrawing samples is continued as before. A little flushing of the face is seen after injection of histamine, and occasionally the patient may complain of palpitations which generally pass off quickly.

In the event of the patient becoming distressed by these symptoms, an injection of 0.5 c.cm. adrenalin chloride should be given; this will give instantaneous relief.

### Examination of gastric contents

#### A. Macroscopic examination.

##### (a) In the fasting juice.

- (i) Amount : measure and note the amount. Normally 20 to 25 c.cm. are found. Marked increase over 50 c.cm. suggests hypo-motility, obstruction, or hyper-secretion.
- (ii) Odour : normally it has no striking odour. An offensive odour suggests cancer, and a sour odour fermentation.
- (iii) Remnants of food or charcoal : normally no food remnants or charcoal are found after 10 hours' interval. The presence of food remnants or charcoal particles suggests hypo-motility, pyloric obstruction, or ptosis.

##### (b) In the fasting juice and in the post-prandial specimens.

- (iv) Mucus in large quantity in the fasting juice, and in many of the later post-prandial specimens, indicates catarrhal gastritis.
- (v) Bile : traces of recently regurgitated lemon-yellow bile may be seen in a few specimens and are usually due to retching caused by the introduction of the tube. A large quantity of turbid green bile in the fasting and in any of the early post-prandial samples is almost always pathological.
- (vi) Blood : macroscopic examination for blood gives more valuable information than the chemical examination. Flecks of fresh blood are usually the result of trauma in passing the tube, while large quantities of fresh blood in any specimen would indicate varices, erosions, or even malignant ulceration of the œsophagus. Blood from gastric ulcer or carcinoma of the stomach is changed to brown acid hæmatin by the acid in the stomach juices; it is found most frequently in the fasting juice, but it may be found also in any post-prandial specimen.

#### B. Chemical examinations.

##### (i) Acidimetry.

Place 5 or 10 c.cm. of clear gastric contents in a shallow porcelain dish. If there be an excess of mucus in any specimen, filter the gastric juice through a plug of cotton wool to remove the mucus; this will then allow of easy titration.

Add a drop of Töpfer's reagent to the gastric juice in the porcelain dish, the presence of free hydrochloric acid will be indicated by the red or orange colour of the juice.

##### (a) Estimation of free hydrochloric acid.

Titrate with N/10 sodium hydroxide until the red or orange colour is discharged : this is done as follows :—

Fill a graduated 25 c.cm. burette with N/10 NaOH up to the zero mark. With one hand regulate the flow of NaOH and allow it to fall drop by drop from the burette into the porcelain dish; stir all the time with a clean glass rod with the other hand. The end point will be shown by a brownish and not a yellow colour. Take the reading of the burette, the difference between the two readings (the first should be zero) gives the amount of NaOH that was required to neutralize 5 or 10 c.cm. of gastric juice.

In clinical work the result is always expressed as the number of cubic centimetres of N/10 NaOH which would be required to neutralize 100 c.cm. of the gastric juice, each cubic centimetre representing *one degree* of acidity. So, the number of degrees of acidity is calculated by multiplying the number of cubic centimetres of N/10 NaOH by 10, if 10 cubic centimetres of gastric juice was used, or by 20, if 5 c.cm. of gastric juice was used.

The result may be expressed in grammes of hydrochloric acid by multiplying the number of degrees of acidity by 0.00365 (an easy way to remember this is that 365 is the number of days in the year, the last figure—5—indicating the number of decimal places).

*Example.*—If 10 c.cm. of gastric juice was taken and if the end point was reached when 2.3 c.cm. of N/10 NaOH had been added, the degree of acidity is  $2.3 \times 10 = 23$ .

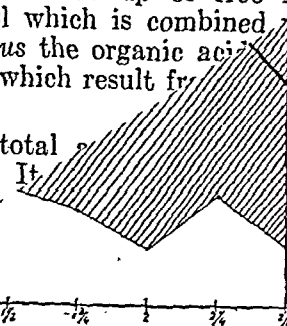
And in terms of hydrochloric acid  $23 \times 0.00365 = 0.08395$  g. of hydrochloric acid.

##### (b) Estimation of total acid.

After the estimation of free hydrochloric acid, or if there be no free HCl at all, 1 or 2 drops of phenolphthalein (1 per cent solution in alcohol) is added as an indicator and the titration with N/10 NaOH is continued until the development of a permanent faint red colour.

The third reading minus the first reading (zero in this case) multiplied by 10, if 10 c.cm. was taken, or 20, if 5 c.cm. was taken, gives the degree of total acid.

The total acidity is made up of free HC<sup>+</sup> together with the HCl which is combined protein and mucus, plus the organic acids as lactic and butyric, which result from fermentation.

The estimation of total acid is of practical importance. It is of marked lactic acid when it may be free HCl. butter, 

tion. mal Indians in Calcutta (gruel test meal).

## YELLOW FEVER\*

By L. EVERARD NAPIER, F.R.C.P. (Lond.)

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**Definition.**—Yellow fever is an acute specific fever of varying severity, but in its most characteristic manifestation of great intensity, and associated with toxic jaundice, caused by a filtrable virus, with a limited tropical distribution, in its urban, epidemic and endemic forms transmitted from man to man by *Stegomyia* mosquitoes, and in its jungle or sporadic form transmitted from its jungle reservoir to man by other means.

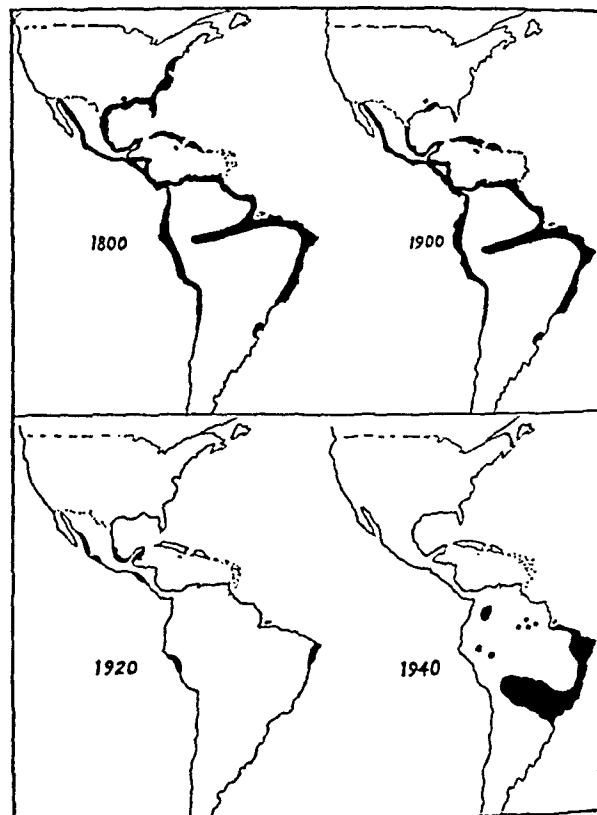
**Introduction.**—The importance of yellow fever to India and countries further east lies in the fact that, though the disease has up to the present never appeared in these countries, there seems to be no explainable reason why it should not invade them at some, near or distant, future date. The history of this disease shows that it is capable of geographical extension, and, in the American continent, from time to time it has invaded countries which were previously immune. In India, the stage is apparently set for an explosive epidemic should the virus ever be let loose here. It is therefore essential that we in this country should take every precaution to prevent this catastrophe and, if this invasion ever occurs, we should be ready to deal promptly with any isolated case that appears, in the hope that we may stamp out the disease before it gets a firm footing.

In this matter India has not only herself to consider, but she has a special mission in being in the front line of the defence of the rest of Asia; she has not only her hundreds of millions of inhabitants to protect, but the thousands of millions in China and the Far East, for, if yellow fever were to gain an effective hold in this country, it is almost inevitable that it would sweep through the rest of tropical Asia, and in these sanitarially backward countries there would be little hope of controlling it until it had run its course and decimated the populations of this and other eastern tropical countries.

Whilst yellow fever is a disease that has from time to time extended its domain, it is, on the

other hand, one that has been very effectively controlled in many countries where it was firmly established and had become a serious menace to the community. Yellow fever has always been held up as an example of how, medical research having shown the way, sanitary organization has put into effect measures that have been brilliantly successful; these measures were so successful that at one time the hope was cherished that eventually man might completely triumph over this disease and finally banish it from the world. However, recent investigations

*Chart demonstrating three phases in the history of yellow fever in the American continent*



Between 1800 and 1900 the disease disappeared largely from the United States as a result of general sanitary improvement.

The complete disappearance from the United States and the reduction in Central and South America between 1900 and 1920 was due to the application of the knowledge that the mosquito *Aedes aegypti* was the main transmitter, and to measures directed against this insect.

The apparent extension of the areas involved between 1920 and 1940 does not indicate any real increase in yellow fever but is due to a better knowledge of the true incidence of the disease, gained by extensive employment of the viscerotome and the mouse-protection test, and to the recognition of the 'jungle form' of the disease.

have brought to light facts which show that this hope is vain. The discovery of the 'jungle' form of yellow fever, the virus of which, if not identical with that of the classical yellow fever, is capable of urbanization, has shown that there is a reservoir of yellow fever which may be limitless and over which man may never be able to exercise effective control.

\* A résumé of a lecture.

(Continued from previous page)

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*India's supposed safeguards.*—It was at one time suggested that there are probably minor differences in the *aedes* mosquitoes of this country which make them incapable of transmitting yellow fever; this has been shown not to be the case for *aedes* collected in this country have been used in transmission experiments and have been shown to be capable of transmitting the infection. A second hope, namely, that dengue, or some other similar widespread infection, might have produced immunity to yellow fever in our populations, has also been shattered by the discovery that, of the many hundreds of samples of blood collected in various parts of India, none showed any evidence of immunity. We are thus thrown back on the vague hope that, as yellow fever has not appeared hitherto, there must be an unknown factor, some special local condition, which prevents its gaining a footing.

It is not necessary to introduce this 'unknown factor', for the explanation may be that the virus has never arrived in this country, either in an infected individual or in a transmitting mosquito, but, because this has not happened in the past, there is unfortunately no guarantee that it will not happen now or at some future date. This danger is vastly increased by the enhanced speed of transport generally, and particularly by the increase in aerial communications between the yellow-fever areas and the rest of the world. The only safeguard then is increased watchfulness to prevent either an infectious patient or an infected mosquito from arriving in this country; the measures that are in operation to effect this will be described below.

*History.*—There is evidence that the disease has existed on the American continent from the time of Columbus; a serious epidemic is reported as early as 1493 in San Domingo. There are many early references to a disease that was undoubtedly yellow fever, from this date onwards, and in the eighteenth century it was so well known that quarantine regulations were introduced in connexion with it. It was endemic over a much wider area in earlier days, but it had disappeared from many old endemic areas, even before the exact mode of transmission was known, presumably as a result of the introduction of general sanitary measures. In America, epidemics were reported as far north as New York and Philadelphia, but during the last fifty years only one epidemic of any importance, that of New Orleans in 1905, has occurred in the United States. In its eastern sphere, it was apparently rife in Spain, including Gibraltar, in the Canary Islands, and all along the west African coast. The disease played an important part in naval and military history: in the sixteenth century Drake's fleet was badly infected after calling at West Coast and Spanish ports, and in 1800 a Napoleonic army that landed in the West Indies was almost completely destroyed by yellow fever.

In 1881, Carlos Finlay, a Cuban of Anglo-French parentage, suggested that the disease might be transmitted from man to man by mosquitoes and carried out experiments to demonstrate this. However, this means of transmission was not generally accepted until the historical experiments were carried out in 1900 by the American yellow fever commission consisting of Walter Reed, James Carroll, Jesse Lazear, and Aristides Agramonte. They demonstrated the *aedes* transmission, and further showed that yellow fever was not transmitted by contact or other means. Lazear died of yellow fever and Carroll, though infected in an experiment by the bite of a mosquito, developed yellow fever but recovered. As a result of these observations, control measures were instituted against *aedes* mosquitoes in Central and South America, and by 1924 the incidence of the disease had been reduced almost to vanishing point.

The next phase of research work dealt with the causative organism. Many organisms were isolated from patients and presented as the cause of yellow fever, but the classical mistake of Noguchi is the only one worth recording, as Professor Noguchi was a brilliant worker who was led down the wrong path by a clinical mistake—not his own, for he was not a doctor. He isolated a leptospira from cases presented to him as yellow fever, and named it *Leptospira icteroides*. It was in fact *Leptospira icterohæmorrhagiae*, the causative organism of Weil's disease, which was the disease that these patients were really suffering from. Noguchi died of yellow fever whilst carrying out experiments in West Africa where, dealing now with true yellow fever, he had entirely failed to confirm his earlier findings—a tragic sequel to perhaps the first mistake of a brilliant investigator.

Meanwhile, Adrian Stokes (who later died of yellow fever), Bauer, and Hudson infected Indian monkeys with yellow fever by means of blood filtrates of patients, and further demonstrated that very small quantities of the serum of yellow fever convalescents protected a monkey.

Hindle in 1928 suggested prophylactic inoculation, and Sawyer in 1932 introduced sero-vaccination, which consisted in giving an emulsion of an infected organ in combination with convalescent serum; the latter prevented the development of the disease, but allowed antibodies to develop. In 1930 Max Theiler produced a neurotropic virus, and by 1934 vaccination with neurotropic virus plus immune serum was a well-established method of yellow fever control. More recently, Findlay, McCallum and others grew the virus *in vitro* on chorio-allantoic chick membrane from which nerve tissue had been removed, and produced a virus that had lost not only its viscerotropic but also its neurotropic, whilst still retaining its antigenic, properties. With this virus,

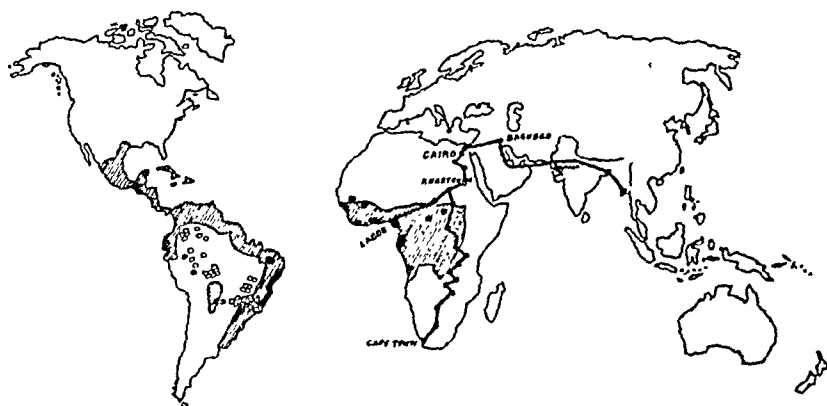


vaccinations, probably numbering millions, have now been carried out.

Other recent advances have been in connection with the transmission of yellow fever. *Aedes ægypti* was at first the only mosquito incriminated; later, other *aedes* were shown to be potential transmitters; then followed the discovery of 'jungle' yellow fever, with its tremendous implications: jungle mosquitoes, notably *Hæmogogus capricorni*, were incriminated as transmitters, with some jungle animal, possibly monkeys, as the reservoir of the virus.

**Geographical distribution.**—Yellow fever is confined almost entirely to the tropics. Most

Distribution of yellow fever.



- Endemic at present day.
- ▨ Past and potential areas of yellow fever as shown by the mouse-protection test.
- Distribution of 'jungle yellow fever' in South America.
- Air routes.

of the endemic areas are on the Atlantic seaboard, though in South and Central America some parts of the Pacific coast are included, and in Africa it extends from the west coast for some thousands of miles inland.

In the American continent, the coastal areas from Mexico in the north, throughout the countries of central and down to the east coast of South America, almost as far as Buenos Aires, all the islands of the West Indies, and on the west coast as far south as Ecuador are all endemic areas, and recently a few foci have been found in Bolivia.

In Africa, it occurs on the west coast from Senegal down to Angola, and inland as far east as the Anglo-Egyptian Sudan, and even into Abyssinia. There are no endemic areas on the east coast of Africa, nor anywhere in Asia.

**Ætiology.**—*The virus.* The disease is caused by a filtrable virus, of the size of about 18 to 27  $\mu$ : it is killed at 60° to 65°C., but survives freezing *in vacuo* for many months. It also withstands the action of some strong disinfectants, such as phenol 1 in 150 at 30°C., but is inactivated by the photodynamic action of methylene blue—1 in 100,000. The virus

may be, (i) viscerotropic (or pantropic)—as in the patient with yellow fever or in animals inoculated subcutaneously or intra-viscerally from such a patient, (ii) neurotropic—after serial inoculation in mouse brain, or (iii) free from any organotropism—after serial cultivation on nerve-free chorio-allantoic membrane. There is evidence that the neurotropic virus can revert to the viscerotropic phase in certain conditions, but there is no evidence that egg-grown virus can re-acquire its viscerotropic or neurotropic tendency.

**Transmission.**—Infection is very easily acquired in the laboratory and many workers have become infected by contact with the blood of a patient or with infectious morbid material from experimental animals.

The mosquito *Aedes ægypti* is the important transmitter of the urban form of yellow fever from man to man; other *aedes* have been shown to transmit it under laboratory conditions. The mosquito becomes infected if it bites a patient during the first three days of the disease; the virus develops in the mosquito for some days before the latter becomes infectious, the

time varying between four and eighteen days according to the temperature at which the mosquito is kept; under natural conditions in the endemic areas, the latent period is about nine days, and from this time onwards the mosquito may be infectious.

The method of transmission of 'jungle', or sporadic, yellow fever has not been established. Certain jungle species of mosquitoes have been shown to be potential transmitters, but in some places the disease has been acquired in the absence of any mosquitoes. In this form of the disease, transmission to man is probably an accident in an epizootic cycle, the disease being normally transmitted from animal to animal by the same, or some other, insect vector; as the animal reservoir, monkeys are suspected, because in jungles where the disease occurs sporadically monkeys have been shown to carry antibodies in their blood.

**Epidemiology.**—High temperatures, 75°F. and above, and high humidity favour the spread of the disease. It is therefore confined mainly to coastal areas in the true tropics, and its highest peak of incidence is in the hot damp months of the year. It seldom occurs much above sea level, though it has been reported from San Paulo (2,500 feet).

The incidence of the disease is conditioned by the number of transmitting mosquitoes, the supply of the virus, and the extent of the susceptible material. *Aedes* is a domestic mosquito and seldom flies more than a hundred yards or so from the house. Ships moored 400 yards from the shore are said to be safe, but



this does not take into account visiting craft, such as lighters, which may transport the mosquitoes from the shore. In the urban form, man is the only source of infection and it is probably mild and unrecognized cases of the disease that are the most important source of the virus. The highest concentrations of the transmitter, the source of infection, and susceptible individuals are found in towns, and it is therefore here that the epidemics occur.

Both sexes are equally susceptible, but the disease appears to occur more frequently in men; this applies in particular to the 'jungle' form of the disease which is almost entirely confined to forest workers. In children the disease takes a milder form, but in old people and in alcoholics it is particularly fatal.

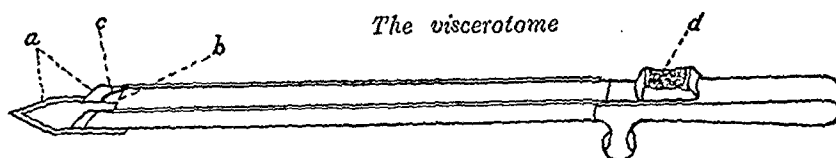
The epidemiology of the disease has recently been studied in two ways, by means of viscerotome surveys and the mouse-protection test (*v.i.*). The viscerotome is an instrument which has been designed for removing pieces of liver without a full post-mortem examination; in all cases of death through an uncertain cause a specimen is taken and examined microscopically (*v.i.*). The mouse-protection test is a test to show the presence of protective antibodies in the blood, and a positive result indicates that the patient has at some time suffered from yellow fever. These two methods have shown the existence of the disease in many parts of South America and Africa where its presence was hitherto not suspected, and the findings have usually been confirmed later by the discovery of clinical cases. In Africa, in certain areas in the Sudan for example, many 'protected' individuals have been discovered, though the disease has never been reported. These have been called 'silent' areas, and, recently, in one such area in the Anglo-Egyptian Sudan, *i.e.*, in the Nuba mountains near Malakal, the 'silence' has been broken by an explosive epidemic. In known endemic areas where the disease has not appeared in epidemic form for many years, children born after the last epidemic have not shown positive protection tests, whereas older children in the same area have provided a large percentage of positives, and finally in Asia and places distant from the yellow-fever areas, no evidence of antibodies has been found in the blood of the inhabitants.

**Pathology.**—The typical post-mortem picture includes the olive discoloration of the skin (in the fair-skinned races) and of all the organs and tissues, ecchymoses all over the body, especially at pressure points, petechial hæmorrhages in the mucous membranes, sometimes extensive hæmorrhages into the stomach, muscles, and other tissues, a yellow nutmeg liver, fatty degeneration of the heart, petechial hæmorrhages in the brain and occasionally

extensive hæmorrhages into the ventricles. Histological examination of sections of the liver shows the characteristic changes that are described below (under *Diagnosis*). In the kidney, there is cloudy swelling and fatty degeneration, more apparent in the convoluted tubules than in the glomeruli, there are hæmorrhages into Bowman's capsule and in the cortex, and the tubules are blocked with epithelial debris. The spleen shows few macroscopical changes, but microscopically there is evidence of endothelial proliferation at the expense of the lymphoid tissue.

The pathology in the jungle form of yellow fever is apparently identical with that of the classical form.

These changes readily explain the diffuse hæmorrhages, the toxic jaundice, the albuminuria and the eventual anuria.



- The viscerotome*
- a. Cutting edges for introducing viscerotome.
  - b. Sliding guillotine blade.
  - c. Groove for sliding guillotine blade.
  - d. Thumb grip for closing the sliding guillotine blade.

### Symptomatology

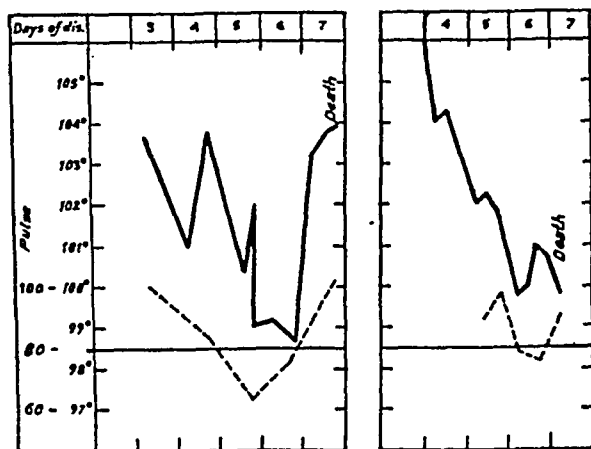
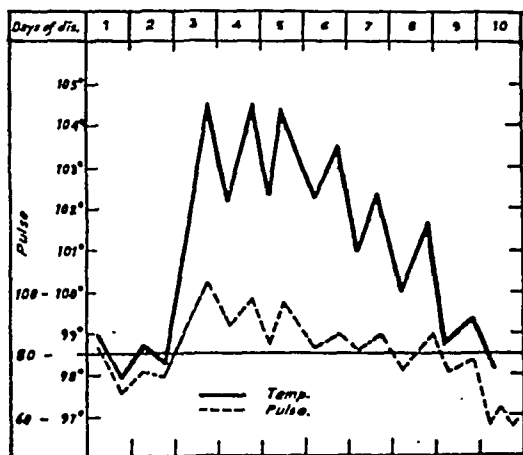
**Incubation period.**—This is usually from two to six days, but instances where the interval was as long as twelve days have been reported.

**The onset.**—In the typical severe case of yellow fever the onset is sudden, with fever and possibly rigor, and a rapid, full and bounding pulse, very severe frontal headaches with pains in the eyeballs and photophobia, pains all over the body but particularly in the loins and bones, an intense burning sensation and dryness of the skin, a furred sharp-pointed tongue with a pink tip and edges, a red and swollen face with the eyes bloodshot and 'beady', anorexia, and severe prostration. In the milder form the onset is more insidious with milder symptoms of the same nature.

**The fever.**—The temperature rises sharply, reaching 103°F. or so in 24 hours and remains high for three or four days; it then falls, usually rather rapidly and may become sub-normal for 24 hours—the 'period of calm', but it may rise again to 101° or 102°F. for another two or three days or more. It is during the 'period of calm' and the reaction period which follows that death is most likely to occur (*vide charts*, p. 174).

**The pulse.**—This is rapid, full and bounding at first, but tends to fall before the temperature; it may drop to 50 per minute or even lower during the 'period of calm' and it seldom rises beyond the normal level during the second febrile period. The steady pulse with a rising temperature or a falling pulse with a constant temperature constitutes Faget's sign, a point of diagnostic importance.

*The skin.*—Jaundice appears on the third or fourth day and is progressive—up to a dark brown colour in severe cases. Earlier appearance is a bad prognostic sign. It is naturally associated in severe cases with yellow discoloration of the sclerotics, bile in the urine and a bi-phasic van den Bergh reaction. Petechial hæmorrhages may appear and a characteristic erythema of the scrotum or vulva is common. In severe cases large purpuric patches appear.



Typical yellow fever charts (adapted).

*Other symptoms.*—Insomnia and restlessness are constant, but delirium is rare except as a terminal condition. Vomiting may occur with the onset of the fever, as with any high fever, but the characteristic severe vomiting occurs from the third day onwards and may assume a coffee-ground character, the typical 'black vomit' of yellow fever, which is always a bad prognostic sign.

*Termination.*—Death may occur in the febrile stage from hyperpyrexia with delirium, or in the 'period of calm' and be associated with profuse hæmorrhages from all mucous membranes, with black vomit, melæna, and hæmaturia, the patient passing into a comatose state. Death seldom occurs before the third day, or after the eleventh, and if the temperature is down by the seventh day the prognosis is good.

*The urine.*—Albumin appears in the urine on the third or fourth day, and is a useful diagnostic sign; in severe and fatal cases it develops earlier. There are usually hyaline casts. Hæmaturia and the presence of bile have already been mentioned. The urine is often scanty and the concentration of urea and uric acid may be low.

*Blood count.*—There is a polymorphonuclear leucocytosis during the early stages, and later on a marked leucopenia with a relative increase of large mononuclears.

### Diagnosis

There are no simple laboratory tests; the diagnosis must be made mainly on the clinical picture and by a process of exclusion. However, the rhesus monkey is a susceptible animal and can be infected from the blood of the patient during the first three days of the disease. Similarly, intracerebral inoculation into mice will cause an encephalitis within seven to fourteen days, but, as other virus infections cause a similar encephalitis, it is essential that such tests should be controlled by protection tests with known immune (yellow fever) serum. Blood taken for such tests will retain its virulence in the ice-chest for a few days; it is therefore important to take the blood at the earliest possible date in a case of suspected yellow fever, even if there may be some delay in carrying out the test, for antibodies will not develop in the blood in the ice-chest, whilst they will in the circulating blood of the patient.

When in the later stages of the infection antibodies develop, their presence can be demonstrated by a specific test, the mouse-protection test; if the patient's serum, after being mixed with the virus and injected into a mouse, protects that mouse from the effects of the injected virus, this is presumptive evidence that the patient has at some time or another suffered from yellow fever. Although these antibodies appear in the blood at an early date and neutralize the virus in the patient's blood, so that mosquitoes are not usually infected after the third day of the disease, for purposes of the mouse-protection test it is recommended that the blood should not be taken before the twenty-second day at the earliest. This test cannot, however, be done in India, as the introduction into India of yellow fever virus in any form is prohibited by law.

Finally, a post-mortem diagnosis can be made by removing a piece of liver and cutting sections of it. This can be done in the usual way, or, in cases where a full post-mortem examination is not allowed, by the use of the viscerotome, the instrument (*v. s.*) used for removing small pieces of liver without opening the abdomen. The tissue removed is placed in Zenker's fluid and histological sections cut. The histological picture in yellow fever is characteristic. The parenchyma cells of the liver undergo a progressive degeneration. They lose their characteristic

shape, become globular and are surrounded by a clear zone; the cytoplasm undergoes coagulative necrosis, it may become vacuolated, and hyaline eosin-staining areas appear; chromatolysis occurs in the nuclei which are usually rounder and smaller than normal, there is at first margination of the chromatin material, and then red acidophil bodies appear; Küpffer's cells become swollen and degenerated; and, starting in the mid-zonal areas, there is eventually complete disorganization of the normal histological picture of the liver. The full range of changes will not be found in all cases, but the most characteristic finding is the 'Councilman cell', a globular cell in which the nucleus has undergone chromatolysis and contains hyaline acidophil bodies.

*Differential diagnosis.*—The most constant and prominent symptoms of yellow fever are fever and jaundice, therefore the diseases with which it is most likely to be confused are severe malaria of the 'bilious remittent' type, blackwater fever, Weil's disease, and catarrhal jaundice. The milder forms of yellow fever might be confused with relapsing fever, dengue, or influenza.

In the malarial fevers the parasite should be easy to demonstrate, also the jaundice appears earlier and tends to improve; in blackwater fever parasites may not be found, but the hæmoglobinuria of this condition should not be mistaken for the hæmaturia of yellow fever. Similarly, in relapsing fever the spirochete is usually found in the peripheral blood. The saddle-back temperature of dengue is not unlike that of yellow fever, but the rash when present is characteristic, there is leucopenia, and jaundice does not occur. The only real difficulty that is likely to arise is in differentiating Weil's disease and in this case we have the precedent of Noguchi's classical mistake.

To exclude Weil's disease a specimen of about 10 c.cm. of blood should be obtained as early as possible during the *first week* of illness. Of this about one cubic centimetre should be inoculated into 10 c.cm. of Vervoot's medium, and 3 c.cm. injected intraperitoneally into a young guinea-pig of 250 grammes weight. The serum from the remaining quantity of blood should be separated with aseptic precautions. Another specimen of 6 c.cm. of blood should be procured at the end of the second week of the disease. The blood culture, the inoculated guinea-pig, and the sera from the two specimens of blood should be forwarded to a laboratory where facilities for examination for leptospiral infection are available. If the case is one of leptospirosis the causal organism will usually grow in the culture medium in ten to fourteen days. *Leptospiræ* will be found in the peritoneal fluid of the guinea-pig about the seventh day after the infective inoculation, and leptospiral antibodies will be demonstrated in the second specimen of the serum.

If there seems to be a serious possibility that the case is yellow fever the utmost precautions must be taken immediately and the patient kept rigidly under a mosquito net day and night. Also it should be remembered that the virus is present in the patient's blood and is unneutralized by antibodies for at least three and in some cases up to five days, and that therefore every care should be taken to prevent his blood touching anyone's unprotected skin during the process of blood withdrawal.

*Immunity.*—There is no natural immunity to this infection. Populations in endemic areas subjected to frequent infection acquire a degree of immunity, and the death rate amongst indigenous inhabitants is very much lower than amongst foreigners.

One attack confers almost complete immunity and it is probable that the partial immunity of natives is due to infection in childhood, when the symptoms are usually much milder and may be overlooked. The degree of immunity of a population can be measured by the mouse-protection test. The test is of little value as an individual diagnostic measure, but is a procedure for obtaining retrospective information regarding the past history of a population, *vis-à-vis* yellow fever.

Immunity can be conferred by vaccination; such immunity is effective about fourteen days after the inoculation and lasts for at least two years.

*Mouse-protection test.*—When a population is to be tested at least 25 adults and 25 children should be chosen at random. Ten to fifteen c.cm. of blood is taken from each and the serum separated. Three c.cm. of the serum to be tested is mixed with 1.5 c.cm. of a 20 per cent emulsion of the brain of a mouse infected with the neurotropic virus. This mixture is then injected intraperitoneally into six mice which have previously had an intracerebral injection of 2 per cent sterile starch solution.

If four or more mice die between five and ten days after the virus inoculation, the test is negative; that is to say there is no evidence of protective substances in the serum tested.

If five survive the test is positive; that is, there is evidence of protective bodies in the serum tested.

An intermediate result is a doubtful result and the test should be repeated. This will necessitate the use of more serum and for this reason some workers advocate taking a larger quantity of blood in the first instance.

The object of including both adults and children is that the results may thus give some indication of the date of the last epidemic visitation, for, if the adults show antibodies but the children none, it may be concluded that the epidemic occurred at least twenty years previously, or prior to the date of birth of the children tested.

### Prevention

For the disease to be spread, there are three requirements—the virus, the transmitting mosquito, and the susceptible population. The last two already exist in many parts of India, and only the presence of the virus is necessary to produce an epidemic. Therefore, the first measure of prevention to be considered is the exclusion of this virus from India. Towards this end a very great deal is being done. Air traffic has introduced a new source of danger and it is on this that most attention is now being centred, though other possible channels of entry, *e.g.*, *via* Bombay and other west-coast sea-ports where for many years precautionary measures have been in force, are not being forgotten.

We must first return to Africa. The planes from Lagos on the West Coast, after passing through active yellow-fever areas, join the Cape-to-Cairo route at Khartoum. There was until recently a regular service from Lagos to Khartoum and thence to Cairo. It is thus obvious that a person could get on board a plane at Lagos in the early stages of the incubation period of yellow fever, change at Khartoum, again at Cairo, where he could pick up the regular service plane from Europe to India, and reach Karachi even before symptoms had developed. Further, Malakal, an aerodrome in the Anglo-Egyptian Sudan on the Cape-to-Cairo route, has long been recognized as a 'silent' yellow-fever area, for a large percentage of the population have antibodies in their blood, as shown by the mouse-protection test, and from time to time suspicious cases have been reported. Such 'silent' areas are potential dangers and from here an infected person might arrive in India at an even earlier stage. It was therefore laid down by the International Sanitary Convention for Aerial Navigation that any person wishing to fly from an endemic area shall reside for at least six days in a non-yellow-fever area, if he has not already had yellow fever, and shall obtain a certificate, signed by the aerodrome health officer, to say that he has complied with these requirements, before he embarks.

Notification is cabled from Khartoum to Karachi whenever a passenger from an endemic area leaves for India, so that all necessary precautions may be taken. In addition to this, no planes are allowed to come to Karachi from the endemic or 'silent' areas unless they have passed through either Khartoum or Cairo, which are anti-amaryl aerodromes, that is to say especially equipped for anti-amaryl (anti-yellow-fever) measures, which include local control of *aedes* mosquitoes and disinsectization of the aeroplanes before they leave, and unless they carry a certificate of disinsectization from one of these two places. For this purpose 'pyricide 20', a pyrethrum spray with a kerosene base, has been used, but deskitol, a similar

preparation with a watery base, is safer and almost, if not quite, as effective.

In India, the further precautions that are taken include another thorough spraying of the inside of the plane after the passengers have disembarked before the luggage is taken out, if the disinsectization certificate is not in order, or if there is on board any passenger who does not hold a certificate indicating that it is at least nine days since he was in an endemic area, detention in a special mosquito-proof ward, to which he is conveyed in a mosquito-proof ambulance, of any such passenger, and, finally, prohibition to enter India by air except at Karachi where the organization for carrying out these measures exists\*.

The sanitary authorities in India have had a great fight with the international authorities to get these measures enforced in other countries, but they insisted on certain minimum requirements, which were eventually acceded to, and have been in operation for some years without much interference with international air traffic. These precautions do not provide an impassable barrier to the entrance of yellow fever, but they constitute a very effective one and it is probably on them that India's immunity, up to the present, has depended.

*Aedes control.*—In towns, this is a measure that has been most successfully carried out in America and Africa. *Aedes* is a very local mosquito, easily controlled by general sanitary tidiness around the house, but repeated inspection is usually necessary when one is dealing with an undisciplined population.

*Aedes aegypti* also transmits dengue and the rapidity with which this infection spreads gives one some idea of how yellow fever would spread if it once gained a footing in India. Special measures are taken at aerodromes and in dock areas to control this species as an extra precaution against yellow fever. In the event of an invasion by yellow fever, *aedes* control would have to be given priority over all other sanitary measures throughout the whole country.

*Aedes* bites during the day-time, so that suspected yellow-fever patients should be kept night and day under a net, or better still in a mosquito-proof room. Also persons dealing with yellow-fever patients, or with their blood or excreta should be inoculated. The same rule applies to laboratory workers doing experiments with animals and yellow-fever virus. It should perhaps be repeated that in no circumstances is one permitted to import yellow-fever virus into India, for any purpose whatsoever.

*Vaccination.*—The various stages through which vaccination against yellow fever has gone are indicated above, and the present position of this protective measure is highly satisfactory.

\* My thanks are due to Lieut.-Colonel E. Cotter, the Public Health Commissioner with the Government of India, for certain details regarding the provisions of the International Sanitary Convention and the procedure adopted at Karachi.

The vaccine is made from a strain which was originally a virulent pantropic virus that has been passaged some hundreds of times on mouse embryo tissue-culture medium until it completely lost its viscerotropic qualities and became a neurotropic virus : then it was passaged, again some hundreds of times, on chick embryo from which the brain and spinal cord had been removed, so that it lost its neurotropic qualities. The first virus thus made caused no serious trouble, but an appreciable percentage of those inoculated suffered from jaundice; this was possibly due to an accidental contamination with some other virus. The present strain is entirely innocuous; the injection is not followed by any local or general reaction; only one injection is necessary, and it produces an immunity which is protective from the fourteenth day and lasts for a considerable time—there is little diminution in the protective power of the blood at the end of a year, but the vaccine has not been in use for a sufficiently long time for us to say how long the immunity will last.

Many people who are coming out to the East, including some coming to India, get inoculated in London before leaving, but wholesale inoculation has not been practised in India yet, though we believe that large stocks of vaccine are being held in readiness for an outbreak. In Africa, wholesale inoculation is being carried out, especially where there is a danger of the jungle form of yellow fever occurring, for no other measure of control is available for this.

#### Treatment

There is at present no recognized specific for this disease, so that the treatment is essentially symptomatic.

The patient should be confined to bed throughout the disease and for some days during convalescence. During the height of the fever the diet should be low and consist mainly of lime whey, albumen water and barley water. Plenty of alkaline fluid should be given, sodium citrate or bicarbonate, by mouth, if possible, otherwise per rectum. Glucose should also be given by mouth liberally, and intravenously, a pint of 5 per cent solution, together with five units of insulin.

Early purgation is recommended,  $\frac{1}{4}$  grain doses of calomel half-hourly up to  $1\frac{1}{2}$  grain, but later purgatives should be avoided.

The following prescription which is designed to reduce acidity is looked upon by some workers as a specific :—

R. Liquoris hydrargyri perchloridi	..	℥ xii
Sodii bicarbonatis	..	gr. vi
Aquam ad	..	℥i

Take hourly.

Other treatment is symptomatic :—

*Vomiting.*—Ten minims of adrenalin (1 in 1,000) by mouth, or  $\frac{1}{4}$  grain of cocaine in an ounce of water.

(Continued at foot of next column)

#### RURAL MEDICAL RELIEF\*

By G. G. JOLLY, C.I.E., K.H.P.

LIEUTENANT-GENERAL, I.M.S.

Director-General, Indian Medical Service

THE subject on which I have been asked to address you is rural medical relief. The title sets one reflecting on the scope of the subject. India is predominantly rural : about 90 per cent of her population live in villages and the problem of medical relief to some 350 millions of rural dwellers out of India's total population of 400 millions is essentially the problem of medical relief in India as a whole.

The tahsil headquarters hospital, though usually built in a town, is intended to serve the tahsil; the district headquarters hospital, sited as it is in an urban area, nevertheless serves the rural population more than it does the urban, while the large central teaching hospitals of a province which are located in the great cities, far from being restricted to urban residents, cater extensively for rural dwellers who are attracted by the fame of the hospital and its specialists or referred thereto by practitioners in the rural areas. The proportion of rural to urban patients admitted to the Irwin Hospital,

\* Being the substance of the opening address at the Women's Medical Conference held in New Delhi on the 16th December, 1940.

(Continued from previous column)

*Black vomit.*—Liquor ferri perchloridi ℥ xv, to be repeated.

*Hyperpyrexia.*—This should be treated by hydrotherapy rather than anti-pyretic drugs.

*Restlessness.*—Phenobarbitone, grains 1 to 3 by mouth or grain 1 intramuscularly.

*Anuria.*—Dry cupping to loin, warm colon wash and warm citrate saline bladder wash, in addition to glucose and sodium bicarbonate intravenously.

Stimulants may be required in the later stages, especially during the 'period of calm' when collapse is not infrequent.

Convalescents should be treated cautiously, especially with reference to diet which should be increased very slowly; indiscretion may have serious consequences.

*Prognosis.*—The disease was at one time considered to be nearly 100 per cent fatal, but later it was realized that a large percentage of the indigenous population enjoyed a high degree of immunity, so that the infection often produced sub-clinical attacks. Even Europeans in Africa suffer from mild attacks which may not be recognized. In most endemic areas about 30 per cent of Europeans suffering from definite clinical attacks of yellow fever die; amongst others the death rate will vary considerably according to circumstances, but in semi-immune populations, it is undoubtedly sometimes a very mild disease, comparable to dengue both in its severity and in its clinical manifestations. In the recent epidemic in the Anglo-Egyptian Sudan, the mortality is reported to be 10 per cent.

New Delhi, is 3 rural to 2 urban. In the Mayo Hospital, Lahore, the percentage of cases from the rural areas is 66.

I would stress this point because there is sometimes a tendency to split medical relief into urban and rural as if they were entirely separate systems, and it is necessary to realize that this is both illogical and impracticable unless economic laws are to be disregarded and an unduly costly and cumbersome system established. Medical relief to any given population requires to be organized in a chain, or rather a series of chains, whose links are located in the various centres of population, large and small, urban and rural, one end of each chain being the general practitioner, the unit, whether in village or town, in immediate contact with the family, while the other end terminates in the central hospital with its exceptional facilities for diagnosis and treatment and its team of specialists.

It is therefore with a realization that the whole range of medical relief in a sub-continent is included in the title of my address that I approach the subject this morning. At the same time, I assume that I am expected to emphasize those aspects of medical relief that are of especial value to the rural dweller and in particular to deal with medical relief agencies sited in the rural areas themselves which comprise the village practitioners and the smaller dispensaries.

There is a dangerous tendency in India to take what appear to be short cuts in medical health work, and to attempt to build from above downwards instead of from below up. These propensities are illustrated by vain endeavours to dispense with the costly foundations of environmental hygiene, such as good water supplies and waste disposal system, and to engage expensive inspecting officers before the rank and file exist for them to inspect.

In the case of medical relief the tendency has been to provide elaborate institutions and specialists at the large centres, contrasting with the most primitive arrangements and practitioners in the villages. The reasons for this are understandable. They are: the small number of qualified medical men, the natural disinclination of these to settle in the villages where life is rough and material reward scanty, and the insistent demand in the towns for better and yet better facilities for medical treatment, supported by the attraction of good fees. Possibly the development that has taken place was inevitable; perhaps it is necessary to fill the towns with medical men before they can overflow to the villages—I don't know.

Of this however I am certain; a sound system as a rural medical relief can only be built upon the foundation of an adequate number of medical practitioners settled in the rural areas. There is no short cut to success here; provincial, district, tahsil hospitals, however well developed, cannot take the place of the general practitioner.

Even rural dispensaries, lavishly distributed as they are in the Punjab, cannot play the part that can only be filled by general practitioners. There is indeed no alternative to the general practitioners' service in the rural areas, whether it is developed as a State service, on a private basis or on the subsidized system. All my experience in the public health and medical services of India has but served to drive home this truth.

In the well-organized village of the future the rural medical practitioner will be able to make a comfortable home and to achieve a reasonable standard of living. Life in the village of the present day however, except in a few favoured spots, is pretty grim and the necessary monetary compensation to lure the young doctor away from the amenities of town life is seldom forthcoming unaided. This is why a number of provinces have tried a system of subsidies, with notable success in Madras where there are some 500 subsidized practitioners settled in the rural areas. In the Punjab I devised a modification of the subsidized practitioner system linked with the co-operative movement. Wherever a co-operative society existed, its members, by paying an extra few annas a month, subject to a total minimum collection of Rs. 50 per mensem, could obtain free medical attendance from a doctor approved by the society, whose remuneration and costs were met in part by the society from these *ad hoc* subscriptions and partly by a subsidy from government. The subsidy is given for specific functions to be performed by the practitioner, including attendance on 'entitled' government servants and medical relief to genuine paupers. Additional duties imposed on the subsidized practitioner would, under this system, be paid for separately. These in the future might include school medical work, vaccination and inoculation and the reporting of vital statistics and epidemic diseases. Such duties should not be imposed at the outset of the scheme or they may easily wreck it. There is a real danger of the 'jack of all trades' who is 'master of none'. Success or failure will depend upon whether the practitioner is a good family doctor inspiring confidence in his diagnosis and treatment and not upon his capability as a sanitary inspector. Duties other than medical relief should not therefore be given in the first instance, or until the practitioner has won for himself a position of trust. On the co-operative medical benefit society side the doctor appointed would be their servant subject to their reasonable rules, and his emoluments would in considerable measure depend upon his popularity with actual and potential society members, since the more people subscribed the higher would be his remuneration.

This system enables government to 'place' medical practitioners in the rural areas at the small cost of Rs. 600 each per annum; it brings modern medical relief within reach of the



villagers at a cost that is not beyond their means, and it guarantees a doctor, settling in a large village or village group, a minimum income of Rs. 100 per mensem to cover his living and professional expenses, an income on which he will not starve and which, if he makes good in his area, he should have little difficulty in doubling before long. It will be appreciated that four annas a month paid by 400 householders with an average family of five gives the doctor a 'panel' of 2,000 and an income over and above his government subsidy of Rs. 100 per month and what he may get in fees from well-to-do persons outside the co-operative society. Naturally the 'medical' benefits received for this small contribution cannot be great but what is needed is a beginning that is financially possible for government, villagers and doctors, that establishes the principle of payment for services received and that holds out prospects of development into an eventual state-aided and controlled system of medical insurance, beneficial to public and practitioner alike.

This scheme, which I have only outlined here, is on trial in the Punjab and its progress is being watched with great interest. If it succeeds the problem of medical relief in the rural areas of India is in my opinion solved. If it fails the failure will put the clock back and be a serious reverse for modern scientific medicine in this country. I am convinced that it can succeed. Modifications and adjustments may require to be made to meet local conditions, but the principles on which the scheme is based I believe to be fundamental and entirely sound.

I come now to the rural dispensary, by which I mean a small permanent self-contained building arranged as an out-patient clinic with, usually, a few beds for emergency cases. Besides the doctor, there are generally a compounder and about two menials, all of whom are housed on the premises. The dispensary costs from Rs. 5,000 to Rs. 10,000 to construct and usually about Rs. 2,500 per annum to maintain. Upon such a rudimentary medical institution, in rural areas devoid of private practitioners from 30,000 to several hundred thousand persons may have to depend for medical relief by modern methods.

Clearly the rural dispensary doctor is an unsatisfactory terminal link to the chain of rural medical relief. Where there is nothing beyond him one would expect him to be completely overwhelmed by demands for urgent casualty treatment alone. Any suggestion that he should take on public health work in addition to medical relief appears merely ludicrous. To demand from him preventive work in an epidemic seems to necessitate a breach of humanity in the neglect of the sick and helpless for the sake of the healthy.

This is all true in a measure. Where, under such circumstances, a dispensary doctor is

efficient, upright, impartial and disinterested, four qualities not easy to obtain together in the conditions of rural dispensary work, he quickly achieves renown and becomes a medical pilgrimage centre famed throughout the district and embarrassed by his popularity. What more often happens is that, if he is reasonably efficient, the villagers nearest his dispensary monopolize his services to the exclusion of the more distant who are obliged to rely upon the vaid and hakim. If, on the other hand, the rural dispensary doctor is below average in efficiency, the chances are that he will become discouraged by the hopelessness of his task, turn lazy, seldom stir from the village in which his dispensary is situated and join the ranks of those public servants who do as little as possible for their pay. This is the explanation of the paradox that in the midst of dire necessity the dispensary sometimes stands half empty. The fault lies with the system rather than with the individual.

What then is the correct rôle of the rural dispensary in the chain of medical relief? I submit that it is to help in the settling of general practitioners in the rural areas and, when they are so established, to act as a 'cottage hospital', serving the area and collaborating with the practitioners in its vicinity. It should in fact be the link between the general practitioners in contact with the families and the district hospitals. With this conception of its rôle in mind it becomes clear that this institution should not be saddled with public health duties. As already noted the general practitioners settled in the villages will in time take on a good deal of this work, but it would be wrong for the rural dispensary doctor to do so. If he is functioning well, he certainly has no time for anything but medical relief. Moreover his assumption of public health duties may postpone the taking up of this work by general practitioners and will certainly delay the development of his dispensary into a cottage hospital. His functions should be clinical and, as soon as there is a sufficient group of general practitioners settled in his vicinity, he should get busy developing the indoor side of his hospital. The rural dispensary, re-oriented as a cottage hospital serving a village group, will as in other countries act as a hospital dépôt or, to use an apt military term, as a casualty clearing station, taking such cases from general practitioners as cannot be treated at home and passing on to the large hospitals those who require special facilities for diagnosis or treatment.

It remains to elaborate the statement, that the rural dispensary should help in the settling of general practitioners in villages. In the Punjab, collateral with the subsidized practitioner scheme there has been developed a system by which the rural dispensary doctor pays regular weekly visits to two or three key villages suitable for the establishment of subsidized practitioners. He holds an out-door

(Continued at foot of next page)



## THE ENUMERATION OF THE BLIND IN INDIA\*

By E. O'G. KIRWAN, C.I.E., M.Sc., M.D.,

F.R.C.S.I., F.S.M.F.

LIEUTENANT-COLONEL, I.M.S.

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IN foreign countries, India is regarded as a land of blindness. Whether this statement is justified or not at present, it is difficult to prove. It is probably correctly written that there are about one and a half million blind persons in India, and for every one person blind there are three partially blind, out of a total population of 3,53,000,000, whereas the census figures of 1931 show a little over three-fifths of a million blind persons.

So far there has been practically no effort to count the number of blind, although the method is very simple to carry out, *i.e.*, a person is considered blind when he cannot count the fingers of a hand held up in front of his eyes at a distance of one foot. This is the method adopted in Egypt and it was also adopted by the Government of Bengal according to my suggestion in the census of 1931.

The first blind relief association in India was started in the Bombay Presidency by the late Mr. C. C. Henderson, I.C.S., in the year 1913. He received the idea and impetus of starting an association like this from the fact that a child of his own was born blind, and he worked till his death for the noble cause of prevention of blindness in India.

This blind relief association carried out a survey of the blind in some districts of the Bombay Presidency and found—in Nasik district 4.4 per thousand, as against the census figures of 1.74; in Bijapore 2.6 as against 0.7; and in Ratnagiri 1.5 as against 0.7.

### Birth of 'A. P. B. B.'

It was felt as far back as 1929 that a society for the prevention of blindness should be started in Bengal. The inaugural meeting was held at

\* Read at the Eighth Conference of the All-India Ophthalmological Society held at Bangalore in December 1940.

(Continued from previous page)

clinic there and sees such serious sick cases as time permits in their homes. When he has worked up a connection and the villagers have begun to appreciate his visits, he suggests that they form a medical benefit society, subscribe the minimum Rs. 50 a month qualifying for the government subsidy, and obtain a resident subsidized practitioner. It is hoped in this way to build up around each rural dispensary a small group of subsidized practitioners in touch with and feeding it just as the dispensary, developed into a cottage hospital, will itself feed the larger hospitals.

Government House, Calcutta, in March 1930, under the Chairmanship of the Hon'ble Lady Jackson, the wife of the then Governor of Bengal. In this way the Association for the Prevention of Blindness, Bengal, came into existence and began to function with a strong committee with the Hon'ble Sir George Rankin, then Chief Justice of Bengal, as President.

The first donation of \$500 dollars was received from Mrs. Winifred Holt Mather, Founder-Secretary, National Society for the Prevention of Blindness, New York, U. S. A., who with her husband came to India in connection with the work of prevention of blindness. This gave a big stimulus in starting this association.

A meeting of the ophthalmic surgeons in Bengal was arranged by the honorary secretary, this meeting was held on 1st of December 1930 and a definite programme of work was planned out. From the beginning, one of the great efforts has been to estimate the number of blind persons in Bengal. This was not actually made possible until the association started the first travelling eye dispensary in India at the end of March 1936. There are now four such travelling eye dispensaries of the association touring through the districts of Bengal. Each unit has two medical officers who, in addition to doing preventive and curative work, carry out a survey of the blind in different villages of Bengal.

In the survey of 379 villages of different districts of Bengal from April 1936 to October 1940, 670 completely blind persons out of a total population of 1,84,477, *i.e.*, 196.91 blind per 100,000 have been found, in contrast to 73 per 100,000 according to the census returns of Bengal for 1931. Our findings for the first hundred, second hundred villages and so on are tabulated below :—

TABLE

Number of villages	Population	Blind	Blind per 100,000
1st hundred ..	78,767	306	388.48
2nd hundred ..	154,167	472	306.16
3rd hundred ..	250,747	600	239.28
Up to 379 villages ..	340,240	670	196.91

To get accurate results, medical officers of the travelling eye dispensaries are instructed to obtain the population figures of the villages from the presidents of the union boards and to base their calculations on the figures supplied by them.

A medical officer in company with the circle officer and with the help of the village chowkidars carry out the actual counting of the blind in the different villages. These are probably fairly reliable.

In the campaign for the prevention of blindness, it is most important to gauge the real position of the number of the blind in India. The Association for the Prevention of Blindness, Bengal, is slowly moving in this respect, and, although it will take many years to complete the work throughout the whole of Bengal, it will eventually produce accurate results.

It will be a pity if the enumeration of the blind is left out of the census of 1941 by the

Government of India, the figures, no matter how inaccurate, are valuable and helpful.

Lastly, if other provinces of India follow the example of this association then it may be possible at a future date to find out accurately the total number of blind persons in India.

My thanks are due to Mr. N. R. Mukerjee, B.Com., for helping me in collecting the figures for this article.

## Medical News

### THE TUBERCULOSIS ASSOCIATION OF INDIA.

*Training courses.*—Two post-graduate courses in tuberculosis under the auspices of the Tuberculosis Association of India were held in Calcutta and Bombay on the 13th and 15th January, and the duration of these courses were three weeks and one month, respectively. Twenty-four doctors attended the Bombay course and 30 the Calcutta course.

These post-graduate courses are, of course, not intended for specialists, but to meet the requirements of general practitioners who wish to do more for tuberculous patients in their practice, and particularly for such doctors as are prepared to co-operate in tuberculosis schemes.

*Tuberculosis institutions.*—In performing the opening ceremony of the Tuberculosis Clinic in the Civil Hospital, Bannu, on the 25th of January, His Excellency Sir George Cunningham, Governor of the N.-W. F. P., paid a tribute to the great services rendered to the people of India by Her Excellency the Marchioness of Linlithgow by raising funds to combat the ravages of tuberculosis. The Clinic has been built at a cost of Rs. 8,000.

*Annual General Meeting of the Tuberculosis Association of India.*—The Annual General Meeting of the Association will take place at the Viceroy's House, New Delhi, on the 25th March, 1941, at 6 p.m. It will be open to the members of the Central Association.

*Tours.*—Dr. C. Frimodt-Møller, C.B.E. (Hon.), Medical Commissioner of the Association, visited Madras from the 5th to 7th January, and gave three lectures to the students of the T.D.D. course instituted by the Madras Government. He also visited Bombay from the 22nd to 24th January and delivered three lectures at the post-graduate course in tuberculosis which has been organized by the Tuberculosis Association of India.

### POINTS FROM THE MINUTES OF THE MEETING OF THE UNITED PROVINCES MEDICAL COUNCIL HELD AT LUCKNOW ON 22ND NOVEMBER, 1940

It was resolved unanimously that having very carefully considered the question of the granting of a certificate of proficiency in allopathy to vaidas and hakims acquiring diplomas from the Board of Indian Medicine, on the ground that they receive a good deal of training in allopathy also, the Council take the view that unless the curriculum of this board conforms to that laid down by the Indian Medical Council or the State Medical Faculty, both in basic education as well as in clinical and scientific training, the Medical Council cannot agree to the proposal.

With regard to the note appended to the report, the Council considered the note of the standing committee regarding the housing of the Council, its committees and the offices and resolved that a more suitable

building with sufficient accommodation for holding the meetings of the Council, its committees and accommodating its offices be rented from the commencement of the next financial year. As the offices of the Council are combined with the offices of the State Medical Faculty and the Nurses Council, consent of these bodies should be obtained before taking action on this resolution and sharing the expenses.

Resolved that the Government be informed that the Drugs Bill was received when it had been passed into law and therefore there was no time for the members to study it. They therefore request that in important matters, which may be referred to them for opinion, the Council may kindly be allowed sufficient time to study the same.

Resolved unanimously that this Council recommends to the United Provinces Government to consult this Council on the report of the United Provinces Medical Reorganization Committee before it is given effect to.

Resolved *nem. con.* that the consideration of the question of recommending to the Government of India that the Indian Medical Council Act, 1933, be so amended as to provide for a majority of elected members on the Council, be postponed to the next meeting.

Resolved unanimously that this Council recommends to the Provincial Government, and through them to the Government of India, that all medical certificates issued by registered medical practitioners or by civil surgeons or railway medical officers be placed on the same footing and all rules and orders to the contrary be repealed at an early date.

### MANUFACTURE OF FISH OILS IN INDIA: AN OLD INDUSTRY REVIVED

At the fourth meeting of the Medical Stores Supply Committee held in New Delhi, the chairman, General G. G. Jolly, director-general, Indian Medical Service, revealed that a flourishing fish-liver oil industry existed in the Madras Presidency 80 years ago. Apparently this flourishing concern was gradually killed by competition in prices.

Medicinal liver oil from the shark and saw-fish is once more being produced in Calicut. It is understood that efforts are also being made by the Governments of Bombay and Bengal and the State of Travancore to manufacture fish oils. Modern research has shown that the use of shark and saw-fish liver oils as a substitute for cod-liver oil is sound practice, since the former are considerably richer in vitamin A than cod-liver oil. Yet long before vitamins were heard of, the medicinal value of shark and saw-fish liver oils was recognized in India where vitamin-A deficiency is widespread.

A modern industry engaged in the production of medicinal fish-liver oil enjoys the advantage that scientific methods for testing and standardizing such oil are available. Investigations about the vitamin content of oil in the Nutrition Research Laboratories, Coonoor, and other laboratories have played an

important part in recent developments. There is an enormous need in India for cheap medicinal products rich in vitamin A and other vitamins.

A Report on the Sea Fish and Fisheries of India and Burma by Surgeon Major Francis Day, Inspector-General of Fisheries, published in 1873, shows that in the sixties of last century there was a considerable production of fish oil on the west coast. For the years 1864-71, the high figure of 3,194,672 pounds with a value of Rs. 2,03,829 is given as the export from Madras alone. This was not medicinal oil, but chiefly sardine oil used for a variety of purposes. But medicinal oil, obtained from the shark and saw-fish, was being

produced simultaneously, apparently mainly for use in India itself. For some years over 5,000 pounds per annum were manufactured, the price ranging from nine annas to Rs. 1-4 per pound. The main centre of production was Calicut, where manufacture was initiated in 1854, the process being under the supervision of the civil surgeon of Malabar.

It is not clear from the report whether medicinal oil was also manufactured in Bombay and Sind. About 1870 the cost of cod-liver oil fell below that of Indian fish-liver oils and apparently the Indian industry languished because it could not compete with the imported product.

## Current Topics

### Improvements in the Operation of Caesarean Section

By J. L. CAMERON, M.D., F.R.C.S.

(From the *Medical Press and Circular*, Vol. CCIII, 19th June, 1940, p. 514)

CÆSAREAN section, whereby the foetus is removed from the uterus by abdominal section, is one of the oldest of operative measures, but historical evidence of the operation having been performed does not appear until about the fifteenth century, although many stories were told of its performance upon the living woman before this date. Details of the procedure and the results are lacking, but we may surmise that the results for the mother must have been fatal in almost every case, as the undertaking was then conducted without hæmostasis or antiseptic precautions.

The first step towards improvement in the operation was doubtless its application to the living woman, and some of the early stories relate that in a few cases the mother survived.

The next advancement, and an extremely important one indeed, is said to have been made by Lebas, who in 1769 attempted to suture the uterine wound. He inserted three stitches, bringing the ends outside the abdomen to provide for their removal later.

Another advance was made in 1877, when Poro of Pavia delivered the child, performed sub-total hysterectomy and exteriorized the uterine stump by suturing it in the abdominal wound. This procedure appears to have considerably lowered the mortality.

In 1907 Frank of Bonn introduced what later became known as the lower segment operation. He also employed a technique whereby the peritoneal cavity was excluded. Selheim, in 1908, further developed the technique of the lower segment operation and demonstrated its advantages.

The greatest strides in technical procedure must, without question, be attributed to the employment of anaesthesia, and to antiseptic and aseptic surgery.

The most up-to-date advancements fall largely into four groups: choice of case, choice of time, choice of technical procedure, and pre- and post-operative management.

**Choice of case.**—This takes into consideration the indications for the operation. There is still some controversy over the type of case for which operation is indicated, but there appears to be a gradual trend towards a more uniform opinion.

Indications are briefly summarized as follows:—

(1) **Cephalo-pelvic disproportion.**—When contraction is extreme, the diameter of the pelvis being less than three inches the indications are absolute, otherwise they are relative.

(2) **Pelvic tumour**, e.g., uterine, especially cervical or low segment fibroid or carcinoma of the cervix, ovarian, vaginal, rectal or parietal growths—or the non-pregnant horn of a bicornuate uterus.

(3) **Malpresentation.**—Breech presentation with extended legs in a primigravida, especially if elderly or

if, as is often the case, there is also some degree of pelvic contraction, is a positive indication.

Oblique presentation may be considered in the same way.

(4) **Ante-partum hæmorrhage.**—Central placenta prævia or even the marginal type should be treated by operation when the case is near term if the child is large, the patient elderly, dilatation slow, and especially if contractions are poor or absent.

Accidental hæmorrhage is an indication only when uterine contractions are absent.

(5) **Uterine dysfunction.**—(a) Primary uterine inertia. Operation is definitely indicated when uterine pains are very short in duration, ineffectual, tending to cease altogether, and failing to respond to the judicious administration of oxytocic substances.

(b) Contraction ring. Operation is indicated in the case of a viable child when the contraction ring (i) lies entirely below the presenting part, or (ii) is situated high up, grasping the neck or body of the child and when steady, prolonged traction has failed to effect delivery.

(6) **Severe pre-eclamptic toxæmia.**—When this condition is present and increases rather than improves under adequate medical treatment, the patient should be delivered by operation, as the danger of eclampsia is imminent.

When eclamptic fits have started Cæsarean section should never be undertaken, for the death rate in such cases is much higher than when treatment by the conservative methods, now well known and established, is employed.

(7) **Maternal systematic diseases.**—Operation is advisable in certain cases of heart disease with failing compensation, in cases of thyrotoxic goitre with marked tachycardia and pronounced nervous symptoms, in active tuberculosis, and in nephritis with low renal function.

(8) **Funicular prolapse.**—This condition only occurs about once in 300 labours, and, the child being usually dead, operation is seldom performed, but is indicated, as the only means of saving the child's life, when prolapse or expression of the cord occurs early in labour, associated with a small os, and especially when the mother is a primigravida. It must also be remembered that with prolapse of the cord the uterus is already potentially infected.

(9) **Elderly primigravida.**—Cæsarean section should be performed when the mother is over 38 years of age when the cervix dilates slowly or not at all, and especially if there is associated cephalo-pelvic disproportion or any malpresentation.

(10) **Previous Cæsarean section.**—This need only be considered as an indication when the previous operation was of the classical variety.

(11) **Stenosis of the vagina and cervix.**—When this condition is present, operation is clearly indicated.

**Choice of time.**—The ideal time to operate is before the membranes rupture, before intra-uterine manipulations, such as attempts at version, rotation or forceps

delivery have been undertaken, and preferably before many vaginal examinations have been made.

If a trial of labour is being made and the membranes rupture, the operation should not be delayed for more than two or three hours.

**Choice of operation.**—The operations which may be employed are: (1) the classical; (2) low segment. (a) intra-peritoneal, (i) by midline vertical incision, (ii) by transverse incision; (b) extra-peritoneal, or by peritoneal cavity exclusion.

One of the greatest advancements has been the extended improvements in the low segment operation which have done much to diminish maternal mortality due to septic peritonitis, post-operative adherence and obstruction of the bowel, and rupture of the uterine scar during a subsequent pregnancy.

## 1. THE CLASSICAL OPERATION

This operation is too well known to require any detailed description. It is definitely contra-indicated in any potentially infected case, such as one which has been long in labour, when the waters have been drained away for more than two or three hours, when the cord is prolapsed, when intra-uterine manipulations have been undertaken, or many vaginal examinations made. It is also contra-indicated when there is shock, collapse, or placenta prævia and in tuberculous or cardiac cases.

The chief improvement in the classical procedure, apart from the observance of the contra-indications, is the adequate suture of the uterine wound.

## 2. LOW SEGMENT OPERATION

### (a) Midline vertical incision

**Procedure.**—Although it renders the operation much easier by enabling the presenting part to gravitate away from the symphysis, bringing the lower segment well into view, the Trendelenburg position is not employed in this procedure as, in that position, liquor and blood tend to gravitate into the peritoneal cavity, increasing the risk of spreading peritonitis.

The vagina is swabbed and the bladder catheterized. The abdomen is opened in the midline for a length of six inches, the lower end being at the symphysis. The edges of the wound are covered with tetra cloths and separated with a self-retaining retractor. Turkish towels, wrung out of hot saline, are packed across the front and sides of the uterus to close off the space and prevent the upward escape of fluid.

The peritoneum, where it is reflected from the front of the uterus, is divided transversely. The bladder is swept off the uterus with gauze mops, and held with a bladder retractor so as to expose the lower segment as far down as possible. The uterus is incised in the midline for five inches, the lower end being well down near the cervix. With a fresh scalpel an incision is started and deepened to about half-way through the muscle and is completed with scissors. The cut vessels are clamped with ring or special wide-jawed forceps and liquor and blood quickly sucked or mopped away.

A hand is inserted and the presenting part lifted vertically upwards through the uterine opening, which can be extended if necessary. The assistant, by pressing strongly upon the fundus uteri through the abdominal wall delivers the child and presses the fundus well downwards. After the cord is clamped and tied, the placenta and membranes are removed, the uterus is inspected and injections of ergometrine and pituitrin made directly into the uterine muscle.

The incision in the uterus is closed with two rows of interrupted stitches, the first uniting the muscle edges by passing in and out superficial to the endometrium. The second stitch oversews the first, heaping up the coapted parts of the muscle to ensure a thick reunion.

All bleeding points are carefully secured with mattress stitches and bleeding from the bladder vessels is arrested with clamp and ligature.

When the extra-peritoneal space is thoroughly dried, the divided edge of the reflected peritoneum is resutured

over the raw area so as to come well above the uterine incision, which is thus completely covered. This suturing is conducted in such a way as to turn the surface of the lower flap of peritoneum against the front of the uterus so that no edge is left exposed.

Clots and blood are removed from the pelvic cavity, and the abdomen is closed in the usual manner.

### (ii) Transverse incision

The lower uterine segment is opened by a V-shaped incision, the other steps of the operation being identical with those already described.

### (b) Extra-peritoneal procedure

**Procedure.**—The patient is placed in the Trendelenburg or half-Trendelenburg position. When the peritoneum at the upper aspect of the bladder has been identified and dissected free with the fingers from the cellular tissues and lower uterine segment, it is clamped across with a pair of forceps on each side above the bladder. Another pair of forceps is applied immediately above these across the peritoneum which is divided with scissors. If the peritoneal sac spreads out too widely, a second pair of forceps on each side will have to be applied across its lower end medial to the first pair. A ligature of catgut is tied in the groove made by the two pairs of forceps at the top of the bladder, which is pushed downwards with a swab and held with a bladder retractor, exposing the lower uterine segment. In the upper part of the wound the lower part of the peritoneal sac will temporarily be held closed with four pairs of forceps.

The peritoneum is gently stripped upwards off the uterus with gauze pressure to give a maximum exposure of the lower segment, care being taken not to tear or open the peritoneum. The two layers of the peritoneal sac held by the forceps are now sewn together with a continuous stitch of catgut, the successive pairs of forceps being removed as the stitching proceeds.

The peritoneum is carefully inspected to ensure that no opening is present. If such be found, it is closed with one or two stitches of catgut.

A broad triangular area of the lower uterine segment is now exposed and is opened by a V-shaped incision, the apex being at the lower end near the retracted bladder. The upper ends need not be more than three inches apart and must not be carried too widely for fear of injuring the uterine vessels. If large veins are seen coursing over the surface in this situation they should be underrun with catgut on a round-bodied needle and tied.

The opening in the uterus is outlined with a fresh scalpel which cuts about half-way through the depth of the muscle, the incision being completed with scissors. Care must be taken not to cut the baby's fingers, ears or genitalia. A sitch of catgut is passed on each side of the incision at the apex of the triangle, the ends being left long.

Large bleeding vessels are controlled with light ring forceps or special wide-jawed forceps. Escaping liquor and blood is removed rapidly with a wide bore suction tube or large mops. Occasionally a small opening can be made in the uterus through which the tube is inserted, and the liquor can be removed with a minimum of soiling of the tissues.

The presenting part is lifted with a hand vertically through the opening which, if made as described, is usually ample. If it is found to be inadequate the upper ends of the V-shaped incision can be extended. As the head is lifted up the assistant presses strongly upon the fundus uteri through the abdominal wall. This fundal pressure is the real power which delivers the child, and it also presses the fundus well downwards, promoting contraction and retraction. This method of delivery is a great improvement on the employment of obstetric or scalp forceps.

The cavity of the uterus is inspected to ensure that no fragments of placenta or membrane remain.

At this stage ergometrine and pituitrin are injected directly into the uterine muscle. The discovery and introduction of ergometrine by Chassar Moir must be

regarded as an important improvement, as it induces immediate and prolonged contraction and retraction of the uterine muscles, thus reducing hæmorrhage to a minimum.

The uterine incision is closed as in the vertical procedure. The extra-uterine space is thoroughly dried and inspected, and any bleeding point must be secured with a mattress stitch of catgut.

The upper end of the bladder is attached with a stitch of catgut to the united edges of the peritoneal sac, and the abdomen is then closed in the usual way.

When the case is potentially septic, the extra-peritoneal space is thoroughly swabbed with acriflavin glycerine (1 in 2,000) before the uterus is opened, and again before the rectus sheath is sutured.

The retrovesical-extra-peritoneal space is drained by a tube passed through the lower part of the uterine wound and vagina, or through the abdominal wall.

**Disadvantages.**—The chief disadvantage of this procedure is that of working in a small space which rapidly becomes filled with blood and liquor amni, greatly reducing visibility. A wide bore suction tube usually overcomes this difficulty.

#### ALTERNATIVE METHOD

In this procedure the parietal peritoneum is opened transversely just above its attachment to the bladder. The loose reflection of the peritoneum from the front of the uterus on to the bladder is lifted up through this opening and divided transversely. These two incisions are continued until they meet.

The bladder is pushed downwards with gauze mop and held with a retractor.

The peritoneal edges are picked up, stripped upwards as far as possible off the lower uterine segment and the two edges sutured together so as to shut off completely the general cavity.

The remaining steps of the operation are identical with those described above.

#### IMPROVEMENTS IN ANÆSTHESIA

Probably the chief improvement in anæsthesia for Cæsarean section is the more extensive use of local infiltration analgesia.

Novocaine (0.25 per cent) in large quantities is used, infiltration being made under the skin to be incised and also into the subcutaneous tissues and peritoneum. Block anæsthesia of the nerves supplying this zone is also made. Large amounts must be injected into the cellular tissues behind the symphysis pubis, a very sensitive region. Incision must not be made until at least five minutes after the completion of the infiltration, thus allowing time for the anæsthetic to act. Whenever pain is felt operating should cease and the painful zone be lavishly infiltrated.

Local anæsthesia is especially useful in cases of shock, cardiac disease with poor compensation or in a tuberculous case.

Spinal anæsthesia would appear to be almost ideal in that it does not in any way affect the baby; uterine contractions and retractions proceed normally; there is absence of pain and the muscular relaxation is complete. There are, however, precautions which must be taken. It should be avoided when there is pronounced shock and when blood-pressure is low. It must be used in the smallest quantities compatible with the desired effect. The anæsthetized zone should not extend above the umbilicus, and when the Trendelenburg or half-Trendelenburg position is used the anæsthetizing substance must be of lower specific gravity than the cerebro-spinal fluid.

Safe general anæsthetics are nitrous oxide and oxygen, or ether and oxygen. Nitrous oxide has little effect on the child, but does not produce sufficient muscular relaxation to permit the low segment operation to be performed easily. Ether, on the other hand, overcomes this difficulty, but it depresses the respiratory centre of the child, especially when the lower segment operation is performed and more time is consumed.

Cyclopropane is said to have the advantages of both these anæsthetics, but its use may be attended by collapse.

A method much in favour is to induce anæsthesia with nitrous oxide and oxygen and to attain muscular relaxation by the addition of ether after the abdomen is opened. To produce as little effect as possible upon the child, the anæsthetic should not be administered until the patient is on the operating table and all pre-operative preparations made. If the operation is started immediately the required degree of anæsthesia is reached, the minimum amount will be necessary.

Another method worthy of note is to supply infiltration together with small amounts of nitrous oxide and oxygen during the operation to allay restlessness and nervous apprehension.

Yet another method is to induce sleep with a minimum dose of either evipan or pentothal sodium and continue with nitrous oxide and oxygen, gradually adding ether.

**Premedication.**—Unfortunately this is not permissible to any satisfactory extent as all the opium alkaloids when administered to the mother have such a depressing effect on the respiratory centre of the child.

Nembutal has been advocated and has been found to have considerable sedative effect when given in 2-gr. doses two hours and one hour before operation.

**Pre- and post-operative management.**—The most important advancement in pre- and post-operative management is efficient antenatal care, whereby the surgeon is warned of approaching danger. Being forewarned, a favourable time can be chosen for the operation and prolonged and futile labour is prevented.

The treatment of shock and hæmorrhage by blood transfusion or intravenous infusion of glucose-saline or gum solutions before operation is undertaken and by intravenous infusions whilst it is in progress is also a useful development.

Important improvements have been made in post-operative treatment. Pain, which is always severe in the abdominal wound and which is sometimes increased by cramp-like uterine contractions, is relieved by lavish doses of morphia. Ergometrine is injected intramuscularly twice daily and when vomiting ceases may be given as a pill thrice daily for four or five days.

If, before operation, uterine hæmorrhage was severe, blood transfusion by the continuous drip method is instituted or resumed. The addition of alcohol to the infusion has a restorative and sedative effect.

The patient should be nursed in the Fowler's position to promote uterine drainage, and, should peritonitis ensue, limit the infection to the pelvic region. Should signs of pyrexia arise, full doses of sulphanilamide or M.&B. 693 should be prescribed.

Abdominal distension is a common complication of Cæsarean section, though usually to a less marked degree when the extra-peritoneal operation has been performed.

Paralytic ileus is a common complication also, and must be differentiated from intestinal obstruction.

A comparatively rare complication except in minor degree, but one which must be kept in mind, is acute dilatation of the stomach, a highly dangerous condition with grave prognosis unless efficiently treated.

Cæsarean section, like all surgical procedures, is dangerous, destructive and deplorable when misapplied, but when well chosen and conducted by the most up-to-date methods is one of the greatest life-saving operations, and it must be remembered that usually two lives are involved.

#### Some Recent Advances in Vitamin Therapy

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Long after beri-beri, rickets, scurvy and pellagra were recognized and described by physicians, the concept of

The synthesis of vitamin B<sub>1</sub> (thiamine hydrochloride) in 1936 accelerated clinical investigation and made possible intensive study of the nature of symptomaticology of beri-beri. Beri-beri, in its severe form, affects predominantly the peripheral nervous and the cardiovascular systems. It is characterized by a symmetrical peripheral neuropathy accompanied by degeneration and atrophy of the muscles supplied by the affected nerves, and by cardiovascular disturbances which include œdema, cardiac dilatation, speeded circulation, high venous pressure and prolonged electrical systole. The study of many patients with beri-beri has shown that they experience a long period of ill health, characterized by prodromal symptoms, before the recognizable symptoms of the disease appear. These prodromal symptoms include loss of weight, strength and appetite.



synthetic chemical substances will relieve indigestion, diarrhoea, burning of the tongue and stomach, burning and itching of the skin, dizziness, forgetfulness, confusion, insomnia and the symptoms of the initial nervous syndrome. Nicotinic acid will also cause disappearance of the abnormal ether-soluble red pigments which are present in the urine of pellagrins, increase the content of coenzymes I and II in the blood and urine and increase the nicotinic acid content of the blood and urine of both normal persons and persons who have a deficiency of nicotinic acid amide.

#### 1938-1939: RIBOFLAVIN

The importance of riboflavin in human nutrition was observed independently by Sebrell and Butler and by the Vilters and Spies. Lesions at the corners of the mouth (cheilosis) were first described by Sebrell and Butler as a typical manifestation of riboflavin deficiency. Erosions around the eyes and a shark skin appearance of the skin over the nose are also characteristic of a deficiency of this substance. Itching, burning and excessive dryness of the eyes, photophobia, granulation and extreme redness of the conjunctiva, particularly of the lower lids, are rather common complaints among persons suffering from riboflavin deficiency. These conjunctival manifestations are often associated with keratitis.

The administration of riboflavin is followed by disappearance of the cheilosis and 'shark skin' lesions of the nose, improvement in general vigour, increase in the sense of well-being, and relief from the ocular symptoms. In addition, it increases the efficacy of nicotinic acid in the treatment of certain pellagrins.

#### 1939-1940: VITAMIN K AND VITAMIN B<sub>12</sub>

*Vitamin K.*—Vitamin K, a fat-soluble vitamin, is essential for the maintenance of a normal concentration of prothrombin in the blood. Animal experimentation and clinical studies have shown that certain hæmorrhagic tendencies are due to a low plasma prothrombin resulting from a vitamin K deficiency. Absorption of this fat-soluble vitamin is dependent on the presence of bile in the intestine rather than on the adequacy of vitamin K in the diet. Lowered prothrombin concentration may occur in conditions in which extensive intestinal lesions interfere with absorption or, more frequently, in conditions in which bile is excluded from the intestine by obstruction of the common bile duct. In such cases the administration of vitamin K will restore the normal prothrombin level. Bile salts, of course, must be given along with the orally administered vitamin in cases in which bile is not present in the intestine; otherwise the vitamin will not be absorbed. Recent work also indicates that newborn infants have a vitamin K deficiency in the first few days of life and that the administration of vitamin K will prevent and cure the hæmorrhagic diathesis in at least many cases of 'hæmorrhagic disease of the newborn'.

*Pyridoxin (vitamin B<sub>6</sub>).*—Clinical studies to determine whether vitamin B<sub>6</sub> is essential to human nutrition were undertaken in 1938, soon after the artificial synthesis of this vitamin was accomplished. Spies, Bean and Ashe, in a preliminary report, described the favourable symptomatic response to vitamin B<sub>6</sub> by four persons who failed to recover completely when on a selected diet supplemented with thiamine hydrochloride, riboflavin and nicotinic acid. The symptoms responding favourably to vitamin B<sub>6</sub> included extreme nervousness, insomnia, irritability, cramping pains in the stomach, weakness, muscular rigidity, and difficulty and awkwardness in walking. More recently we have treated twenty additional patients with similar results. Vilter, Schiro and Spies reported that this vitamin, when administered in large amounts, produced a slight reticulocytosis in persons who have macrocytic anæmia associated with pellagra or pernicious anæmia in relapse. These studies, however, do not imply that vitamin B<sub>6</sub> is an anti-pernicious anæmia factor or the extrinsic factor of Castle. Improvement has been noted following the intravenous administration of vitamin B<sub>6</sub> to some patients with idiopathic epilepsy and to persons with amyotrophic lateral sclerosis. One of us (T. D. S.)

has seen three cases of myasthenia gravis which showed pronounced improvement within twenty-four to forty-eight hours after the injection of vitamin B<sub>6</sub>.

On the basis of the dramatic and beneficial effect of vitamin B<sub>6</sub> in relieving muscular weakness and rigidity, an effort was made to determine whether a similar response would follow its administration to persons with Parkinson's syndrome, a severe lingering disease characterized by tremor of the extremities, weakness, delay of voluntary motion and muscular rigidity. In April last Dr. Norman Jolliffe reported the effect of vitamin B<sub>6</sub> in relieving the rigidities and weakness in certain cases of paralysis agitans (Parkinson's syndrome). More recently Spies reported before the Illinois State Medical Society the results of studies concerning the use of vitamin B<sub>6</sub> in eleven selected cases of parkinsonism of at least four years' duration, eight of which were arteriosclerotic and three post-encephalitic. Within a few minutes there was much improvement in the latter three. Rigidity was decreased significantly and the patients were able to walk without the usual stiffness. Two of the arteriosclerotic patients showed definite improvement, five were unchanged and one was considerably worse. Dr. Jolliffe has stated that in a study of thirty patients with paralysis agitans he observed 'no apparent improvement in the post-encephalitic group, little or no improvement in any group of patients hospitalized for over three years and dramatic improvement in approximately 20 per cent of the patients with nonpost-encephalitic parkinsonism who had been helpless for less than one year'. These preliminary observations indicate to the authors that rigidity in some cases seems to be decreased and that vitamin B<sub>6</sub> should have more careful study. It seems likely that some persons with Parkinson's syndrome may have an associated vitamin B<sub>6</sub> deficiency, for indeed it is the close resemblance of the rigidity and awkwardness in walking observed in patients suffering from either disease which prompted us to administer vitamin B<sub>6</sub> to those with Parkinson's syndrome.

Many more studies are necessary before conclusive statements can be made concerning the effect of this vitamin on persons with various diseases. It must be emphasized that a sedative effect of vitamin B<sub>6</sub> may be responsible, in part at least, for the rapidity with which symptoms are relieved and that the administration of this vitamin is warranted only under controlled conditions.

#### 1940: VITAMIN E, YEAST ADENYLIC ACID AND PANTOTHENIC ACID

*Vitamin E.*—For several years it was believed that vitamin E was concerned specifically with reproduction. During the past decade, however, a definite relationship between an inadequate intake of vitamin E and the normality of the cross striated musculature of the body has been established. Characteristic muscular atrophy occurs in widely divergent animal species when vitamin E is withdrawn from their diets. Restoration occurs following the intramuscular injection of synthetic alpha-tocopherol (vitamin E). During the past year Wechsler and Spies and Vilter observed independently that synthetic alpha-tocopherol has a beneficial effect on occasional persons with amyotrophic lateral sclerosis. The injection of 500 mg. of alpha-tocopherol in sterile oil is effective, at least temporarily, in relieving neuromuscular symptoms, roaring sensations in the ears, anorexia, and insomnia of selected persons with malnutrition but without clinical evidence of pellagra, beri-beri or riboflavin deficiency. We have observed striking improvement in a few of these people following the administration of vitamin E, but it is difficult to measure objectively the degree of improvement. It would seem that the patients who experience the greatest relief are those who also have some deficiency of vitamin E.

Clinical studies of the therapeutic effect of vitamin E are still somewhat in an experimental stage, and until further work is done the administration of this substance is warranted only under controlled conditions.



**Yeast adenylic acid.**—Adenylic acid is a constituent of the pyridine dinucleotides, coenzymes I and II, and since these intracellular enzymes are fundamental to physiologic processes it was felt that adenylic acid merited consideration for study in the treatment of persons with mixed deficiency diseases. Accordingly, we administered yeast adenylic acid to normal persons and to poorly nourished persons who had symptoms which were not relieved by nicotinic acid, thiamine hydrochloride, riboflavin, vitamin B<sub>6</sub> or vitamin A. The injection of from 3 to 20 mg., dissolved in sterile physiologic solution of sodium chloride, within fifteen seconds produced involuntary, deep, gasping inspiration, fluttering sensation in the upper part of the abdomen and a feeling of fullness in the head. All patients had transient flushing of the neck and face, and the pupils became widely dilated. These symptoms vanished within a few minutes and left no evidence of a harmful effect. Less intense symptoms of the same type followed the administration of a single dose of 200 mg. of adenylic acid by mouth. Six patients with malnutrition who had intense burning of the oral mucous membranes but no diagnostic evidence of pellagra were relieved following treatment with adenylic acid. The administration of this substance together with nicotinic acid to a series of pellagrins in relapse seemed to increase the effectiveness of the nicotinic acid. However, because of the severe reactions produced by the intravenous injection of yeast adenylic acid we do not recommend its administration to human beings.

**Pantothenic acid.**—The structure of pantothenic acid (the chick antidermatitis factor) has been determined and early in 1940 its synthesis was accomplished. Now that it is becoming available for clinical investigation, studies on its relation to the blood, urine and tissues of human beings are in progress. Since there was no information regarding the possible toxicity of pantothenic acid, we administered this substance, under controlled conditions, to a series of normal persons and found that at least 100 mg. may be injected intravenously without producing a reaction or causing a significant change in the blood pressure, pulse or respiration. Spies, Stanbery, Williams and Jukes observed that the pantothenic acid content of the blood is increased soon after injection but returns to its previous level within twenty-four hours. Stanbery, Snell and Spies have shown that the pantothenic acid content of the blood of persons having severe deficiency diseases, such as pellagra, beri-beri and riboflavin deficiency, is from 23 to 50 per cent lower than in normal persons and that with a rise in the pantothenic acid content there is a simultaneous increase in the riboflavin content of the blood. The patients with an abnormally low concentration of pantothenic acid in the blood have also had less than normal in the urine. These observations suggest that pantothenic acid is important in human nutrition.

#### GENERAL CLINICAL CONSIDERATIONS OF DEFICIENCY DISEASES

**Factors operating to produce deficiency states.**—The factors that operate to produce nutritional deficiency diseases are an inadequate intake, increased need, diminished absorption or utilization, or increased destruction or excretion of the essential nutritional substance or substances. Clinical study of deficiency disease syndromes in 3,500 persons, including the 1,500 reported in this paper, has shown that single deficiency states seldom exist. This is not surprising since the dietaries of persons in whom these diseases most frequently occur are deficient in many essential nutrients. The resultant clinical picture is extremely complex; we frequently see evidence of pellagra, beri-beri, riboflavin deficiency, scurvy, vitamin B<sub>6</sub> deficiency, vitamin A deficiency and anemia in the same person. The diagnosis of one clinical deficiency syndrome, therefore, necessitates a thorough search for others.

**Factors of safety operating to correct deficiency states.**—Certain factors of safety operate to protect the body and to compensate for a deficiency of these essential substances once the deficiency has set in. A wide

margin of safety exists between the beginning of a dietary deficiency disease and death from it. We have reported cases in which rest alone was followed by some improvement and, in certain instances, by healing of the lesions characteristic of a specific deficiency state. More recently we have observed a significant increase in the blood concentration of coenzymes I and II following rest in bed. When treating persons with nutritional diseases, one should therefore curtail their activities as much as possible until restoration of the affected tissue to normal is under way. Another factor of safety is the storage of these essential substances which takes place to some extent in the tissues. Also the body tends to excrete less when a deficiency exists. Nevertheless there is a limit to this self regulation and, if the deprivation of these substances continues, irreparable damage to the tissues will result.

#### PRINCIPLES OF THERAPY FOR DEFICIENCY DISEASES

**General therapy.**—The following general principles of therapy are applicable to all deficiency diseases: Each patient must be considered as an individual problem and treatment prescribed accordingly. A well balanced diet of 4,500 calories, rich in protein, minerals and vitamins, should be eaten each day. The type of food, the mode of administration and the time and frequency of feeding in the more severe cases are dependent on the patient's condition and on his ability to tolerate food. Complete reliance on dietary therapy, however, is not recommended, for the necessary protective substances are present in too small amounts to be effective in cases of well developed deficiency diseases. Furthermore, persons of the lower income group who are most frequently affected by nutritional diseases cannot afford to buy the relatively expensive foods rich in vitamins and protein. Specific therapeutic agents, then, should be given as supplements to a well balanced diet. In the very severe case hospitalization is advisable, for the combined services of a physician, nurse and dietitian are essential. The patient should be kept at complete rest in bed until convalescence is well established. If for any reason the food requirement is increased, efforts must be made to eliminate the cause. Appropriate symptomatic therapy and treatment of coexistent diseases are of course desirable. Treatment in all cases should be based on all the clinical evidence available.

**Specific therapy.**—Specific therapy in the form of large doses of synthetic chemical substances induces more rapid and dramatic remission of symptoms of the specific deficiency diseases, shortens convalescence in the severe case, and assures more certain recovery. The indication for therapeutic use of synthetic vitamins and concentrates of yeast and liver is very large indeed, but indiscriminate use is not consistent with the interests of the patient.

Beri-beri is treated best by giving pure crystalline vitamin B<sub>1</sub> (thiamine hydrochloride). The administration of 20 mg. a day in 10 mg. doses is recommended for the average case of beri-beri in the adult, and for the severe case from 50 to 100 mg. administered in divided doses. Ten mg. daily may be sufficient for the mild case. Infantile beri-beri is treated best by giving 5 mg. of thiamine hydrochloride, dissolved in sterile physiologic solution of sodium chloride, twice a day, or 10 mg. by mouth each day. The treatment of the nursing child will be greatly aided by giving the mother satisfactory anti-beri-beri treatment. Vitamin B<sub>1</sub> may be administered either orally or parenterally, but the latter method is preferred in the acute case because of the greater ease in giving massive doses, the greater certainty of absorption and the more rapid improvement which follows.

Nicotinic acid, nicotinic acid amide and sodium nicotinate are effective in the treatment of pellagra. These substances may be administered orally in tablets or capsules, or parenterally, dissolved in sterile physiologic solution of sodium chloride. The average adult patient will respond to the oral administration of 500 mg. daily, given in divided doses of 50 mg. each, though as much as 1,000 mg. a day may be required in the very severe cases. The parenteral dose varies

from 50 to 80 mg. daily, injected intravenously in doses of from 10 to 15 mg. Nicotinic acid amide has an advantage as a therapeutic agent in that it does not produce vasodilatation of the skin or an increase in the temperature of the skin which so frequently follows the administration of nicotinic acid and sodium nicotinate.

From 3 to 5 mg. of riboflavin, administered orally in tablet form or intravenously in sterile physiologic solution of sodium chloride, is effective for the average case of riboflavin deficiency. Since riboflavin is not very soluble in saline solution, the oral method of administration is recommended.

Very little is known concerning either the maintenance requirement or optimal dosage for vitamin K. Early work indicates the maximal prothrombin response is obtained when the crude vitamin extracted from 300 gm. of alfalfa is given orally over a period of from three to four days. Recent work has shown that the oral administration of from 1 to 5 mg. daily of 2-methyl-1, 4-naphthoquinone usually will give excellent results, though for some cases this amount will have to be increased. Since complete absorption is dependent on the presence of bile in the intestine, it is necessary, when vitamin K is administered orally, to give bile or bile salts along with it, as for example in cases of obstructive jaundice. Satisfactory results are obtained if the daily dose of the vitamin is emulsified in from 1 to 2 ounces (30 to 60 c.c.) of bile or is given with a comparable amount of animal bile salts.

The intravenous injection of 50 mg. of vitamin B<sub>12</sub>, dissolved in sterile physiologic solution of sodium chloride, is effective in the treatment of symptoms of vitamin B<sub>12</sub> deficiency. Evidence indicates that vitamin B<sub>12</sub> will relieve, at least temporarily, certain other conditions as described in the section on vitamin B<sub>12</sub>; but, since response is not uniformly observed in all cases, its use is not recommended until further study has been made.

Vitamin E (synthetic alpha-tocopherol) in sterile oil, injected intramuscularly in dosage of 500 mg., relieves temporarily the symptoms of weakness and pain in the legs. In some cases a second injection of 500 mg. may be required.

Because of the severe reactions produced by the intravenous administration of adenylic acid, its use is not recommended.

Stanbery, Snell and Spies have shown that the content of pantothenic acid in the blood and urine is from 23 to 50 per cent lower in persons having pellagra, beri-beri and riboflavin deficiency than in normal persons.

In the mild and moderately severe cases of mixed deficiency disease, dry powdered brewers' yeast (from 75 to 100 gm.), liver extract (from 75 to 100 gm.) or wheat germ (150 gm.) daily should be given orally as supplements to the diet. Yeast and wheat germ have an advantage over the pure chemical substances in that they contain nicotinic acid, vitamin B<sub>1</sub>, riboflavin and vitamin B<sub>6</sub>, as well as minerals, proteins, enzymes and salts, and probably still other as yet unknown essential factors. A strain of yeast, designated C-50, furnished by Anheuser-Busch, Inc., for experimental purposes, has been found more palatable than the other strains we have used. Many of the patients who objected to the taste of brewers' yeast will take it without complaint when it is combined up to 25 per cent with peanut butter or catsup.

#### SUMMARY AND CONCLUSIONS

During the past year and a half, 1,500 persons with clinically associated deficiency disease syndromes have been treated without a death. (The death rate from severe pellagra alone a few years ago was often as high as 54 per cent.) Our studies indicate that these people have a mixed rather than a single deficiency disease, and from a practical standpoint the response of these persons indicates that mixed vitamin therapy is often desirable. We recommend the administration of water-soluble vitamins together, rather than individually, and fat-soluble vitamins together, rather than individually, as having a definite usefulness in the

treatment of deficiency diseases. Even when specific therapeutic agents are administered in the treatment of deficiency diseases, persons of all ages should also be given a well-balanced high-calorie diet.

## Reviews

**WAR WOUNDS AND INJURIES.**—Edited by E. Fletcher, M.A., M.B., M.R.C.P., and R. W. Raven, F.R.C.S. (Based on articles in the 'Post-Graduate Medical Journal'—Fellowship of Medicine.) Edward Arnold and Company, London. Pp. viii plus 262. Illustrated. Price, 14s.

THIS little book, based on articles which have appeared in the *Post-Graduate Medical Journal*, gives a résumé of the present state of knowledge of war surgery. The contributors all seem to have derived their experience from the war of 1914-1918, but they have brought it into line with the great progress that traumatic surgery has made during the post-war period. The first three chapters, on shock, gas gangrene, and tetanus, contain plenty of evidence of the advances that have been made in recent years.

The succeeding chapters deal with injuries of the various regions, the chest receiving special attention.

Lord Horder in his foreword suggests that a chapter on burns and another on sepsis would improve a second edition. Doubtless room will also be found for chapters on the early treatment of wounds and compound fractures. The book can nevertheless be recommended as it stands, and it is one that should find many eager readers in this country.

W. McN. N.

**THE FOOT AND ANKLE: THEIR INJURIES, DISEASES, DEFORMITIES AND DISABILITIES.**—By Philip Lewin, M.D., F.A.C.S. 1940. Henry Kimpton, London. Pp. 620, with 303 illustrations. Price, 42s.

A LARGE part of this book consists of a review of the orthopaedic surgery of the ankle and foot. The author has gone to great pains to collect from the literature the best monographs; and much of the original text, especially of those describing operative technique, has been reproduced in full.

In an endeavour to make this as complete a work as possible the author devotes many chapters to ancillary subjects, such as the circulatory disturbances of the lower extremities, varicose veins, and rickets. There may be something to be said for the inclusion of these chapters, but it is difficult to find justification for the opening pages of the appendix at the end of the book. Here are to be found, under the title 'Footnotes and Footsteps . . . Pedigrams', about a hundred disconnected sentences of doubtful value and still more doubtful wit. Thus 'Take the arch out of your back and put it in your foot' is followed by 'Foot—care is good foot insurance'. Others of a like nature are also to be found scattered throughout the book. They do not adorn what otherwise is a valuable surgical monograph.

W. McN. N.

**THE ART OF SURGERY: A TEXTBOOK FOR STUDENTS AND PRACTITIONERS.**—By H. S. Souttar, D.M., M.Ch. (Oxon.), F.R.C.S. (Eng.). In two volumes. 1940. William Heinemann (Medical Books) Limited, London. Pp. x. plus 779. Illustrated. Price, 25s.

THIS book was originally published in one large volume in 1929 and it met with quick success. After three editions it has now appeared in a more attractive form in two volumes presenting many new features. In spite of this the price has been reduced to 25 shillings.

The first volume, consisting of 402 pages and 29 chapters, deals with general surgery, diseases of bones

and joints and the nervous system. Volume 2, containing 25 chapters and 2 appendices, though somewhat smaller, deals with special subjects, including thoracic, abdominal, and genito-urinary surgery. Mr. Souttar's book is so well known that it requires no introduction. In this edition large sections of the book have been entirely rewritten and brought fully up to date. Though we are far from the turmoils of Europe, we realize that under present conditions lavishly illustrated and leisurely volumes are both outmoded and impracticable for constant use. The author's characteristic marginal drawings are numerous and are not merely effective but also conducive to economy of words.

In spite of its conciseness, this book is neither a mere 'aid' nor a synopsis. The senior student will find that it contains all that is necessary for most examinations in surgery. We agree with the author that 'it will provide the reader with a solid framework into which to fit the experience which alone can make him a surgeon'. There is such great charm in the author's diction and power of description that the book easily becomes a companion. We have no doubt that the present edition will meet with as ready a welcome as its predecessors. The printing, get-up and illustrations do great credit to the publishers.

P. N. R.

**A MANUAL OF OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY.**—By Howard Charles Ballenger, M.D., F.A.C.S. 1940. Henry Kimpton, London. Pp. 302. Illustrated with 90 engravings and 4 coloured plates. Price, 18s.

THIS manual is intended for the student who can only spare a limited amount of time to the study of oto-laryngology. Written by the junior author of Ballenger's *Diseases of the Nose, Throat and Ear*, some of the text and most of the illustrations have been taken from the larger work. Reference to the original text reveals that considerable condensation has been made, but this has been well done, and indeed the subject-matter is often more readable. Omissions consist chiefly of operative procedures, alternative methods of treatment, and details of the rarer conditions.

Amongst the illustrations, a coloured plate depicting various diseases of the tympanic membrane is the best that we have yet seen.

This book in no way supplants the larger volume, whose merits are already well known; it should achieve popularity on its own account among those for whom it has been written.

W. McN. N.

**TEXTBOOK OF MEDICINE.**—By Various Authors. Edited by J. J. Conybeare, M.C., D.M. (Oxon.), F.R.C.P. Fifth Edition. 1940. E. and S. Livingstone, Edinburgh. Pp. xx plus 1131. Illustrated. Price, 24s. Postage, 8d.

LITTLE need be said about the new edition of this well-known book, for it is less than two years since the last edition appeared and was reviewed in this journal. The book is particularly designed for the student for revision of the subject of medicine, but it will equally well serve the practitioner as a reminder of the outstanding points in the pathology, diagnosis and treatment of diseases which he encounters in his daily round.

Nearly all the important cosmopolitan diseases are well, though concisely, described and the latest established methods of treatment are given. The necessity for conserving space has compelled the author of the section on tropical infections to carry compression too far, so that the diseases in this section are little more than medical dictionary descriptions. Even this does not excuse reference to distribution of the lesions of espundia as 'the converse of oriental sore' whatever that may mean, and a description of the initial lesions as occurring in the mucous membranes. The statement that 'Plasmoquine acts mainly on the sexual forms of the parasite and hence is not curative, but diminishes

the relapse rate', suggests a fundamental inappreciation of the life cycle of the malarial parasite, but is probably only a tragedy of compression: nevertheless, it might be clarified, or removed, in the next edition. Otherwise, we found little to criticize in this book which we can thoroughly recommend to the student.

**THE THYROID: SURGERY, SYNDROMES AND TREATMENT.**—By E. P. Sloan, M.D. 1936. Baillière, Tindall and Cox, London. Pp. ix plus 475, with 99 figures. Price, 45s.

THROUGH a series of mischances this book, which was sent to us some years ago, has not been reviewed. It is not however a book that dates, and we feel that we could like to draw our readers' attention to it, even at this late date.

No anatomical structure in the human body involves so many specialists, when it departs from the path of normal growth and function, as does the thyroid. The physician, the surgeon, and the gynaecologist, the neurologist and the psychiatrist, the cardiologist, the laryngologist, and the ophthalmologist, the biochemist and the radiologist, all play an active part in the diagnosis and treatment of the various disabilities associated with thyroid hyper-, hypo-, and dysfunction. It is therefore not a subject for a one-man monograph; the book under review bears one name on the cover, but is really the work of a team of workers, members of the staff of the Sloan clinic.

It contains a well-balanced account of the subject in all its aspects and is an invaluable reference book for anyone interested in the thyroid gland, whether from the medical, surgical, or other points of view. There is an excellent bibliography, and a large series of beautiful coloured plates illustrating stages in the operative treatment of thyroid disease.

**INFANT FEEDING.**—By Alan Moncrieff, M.D., F.R.C.P. 1940. Edward Arnold and Company, London. Pp. iii plus 30. Price, 1s. 6d.

THE author enunciates three simple general principles of infant feeding which are too often overlooked; firstly, that each infant is an individual whose needs cannot be standardized, secondly, that the essence of successful infant feeding is common sense in the medical adviser and in the mother, and, thirdly, that a knowledge of simple mental arithmetic will solve most 'quantity' problems.

The feeding of the infant and the pre-school child is simply stated, aids to the successful establishment of breast feeding are discussed, and clear directions are given for calculating the values of the commoner supplements. Some of the subject-matter in the chapter on artificial feeding has less application for the Indian infant, but it is concise and well presented. Lactic acid milk is not dealt with.

The chapter on the feeding of premature infants might have been more comprehensive: the value of the addition of vitamins A and D to the feeds is not discussed. The difficulties and trials experienced in rearing the premature baby are not overlooked and the management of feeding is dealt with in some detail.

This is a useful and practical book of somewhat conservative outlook, at a modest price, although not the ideal textbook on the subject for Indian conditions.

L. G.

**THE PERIODICITY AND CAUSE OF CANCER, LEUKAEMIA AND ALLIED TUMOURS: WITH CHAPTERS ON THEIR TREATMENT.**—By J. H. Douglas Webster, M.D., F.R.C.P.E., F.F.R. 1940. Baillière, Tindall and Cox, London. Pp. xv plus 178, with 5 illustrations, 8 charts and 8 tables. Price, 12s. 6d.

THIS book is the result of an analysis of over 800 cases of neoplastic diseases to find out whether the active phases of such diseases as carcinoma, sarcoma, leukaemia, Hodgkin's disease and certain benign tumours, show any characteristic periodicity. The author states that he has discovered this to be the case in about 96 per cent of the cases studied by him.

This periodicity has shown three varieties: '(a) a standard period of thirty-three weeks (eight lunar months); or (b) half periods of approximately sixteen and a half weeks (four lunar months); or (c) multiple periods of any multiples of (a) and (b) (the intervening maxima being suppressed).' He also states that there is a seasonal periodicity about these diseases with a maximum in January to April. He finds that manifestations of periodicity are independent of treatment and that when recurrence has taken place after a long period of latency, the periodicity has been resumed as if it had never been interrupted.

The author claims sixty successful predictions of recurrences made in cases of malignant disease and considers his observations on periodicity and histological features like inclusion bodies in Paget's cells in Paget's disease, as affording circumstantial evidence in favour of the virus theory.

The author has also discussed applications of his theory to problems of diagnosis, prognosis and treatment.

The thesis is clearly presented and in great detail. It deserves to be considered a definite contribution to the study of neoplastic diseases and, when confirmed by other workers in the field, would help to bring these conditions in line with infectious diseases of known aetiology, the course of which is characterized by periodicity.

V. N.

**A HANDBOOK OF TOXICOLOGY.**—By B. K. Dutt. 1940. Published by Amlia Kumar Dutt, 89/C, Garpar Road, Calcutta. Pp. II plus 83. Price, Re. 1-8

This is a small handbook meant for students of the medical schools of India. The subject is divided into sections, such as poisoning in general, corrosive poisons, non-metallic irritant poisons, metallic irritant poisons, animal irritant poisons, cerebral poisons, spinal poison, cardiac poisons, and asphyxiants. The poisons are discussed in the form of charts and 28 of the common poisons have been thus treated. The text seems to lack careful editing, and printing mistakes are seen too often to be ascribed to the press alone. The book will be welcomed by students for a rapid revision of the subject before an examination.

S. G.

**CHEMISTRY. CATECHISM SERIES. Part I:—Inorganic. Fifth Edition. Part II:—Inorganic and Organic. Fifth Edition. E. and S. Livingstone, Edinburgh. Pp. 76 in Part I, and pp. from 77 to 152 in Part II. Price 1s. 6d. and postage 3d. for each part.**

In these two small volumes the whole subject is discussed in the form of questions and answers. The answers are short and in most cases explained with equations. These books are not expected to replace the standard texts on the subject but are helpful to students for a rapid revision of the important portions before an examination.

S. G.

**THE RISE AND GROWTH OF THE ALEMBIC CHEMICAL WORKS: A HISTORY.**—By Raj Mitra B. D. Amin, B.A., M.S.C.I. (Lond.), Managing Director. 1939. Printed and published for and on behalf of the Alembic Chemical Works Company, Limited, by N. R. Iyer at Alembic Printing Press, Baroda. Pp. 188 plus xv. Illustrated

This book is a record of the development of a leading firm of manufacturers of spirit and pharmaceutical products in western India. It discusses the various difficulties and problems that faced this indigenous concern ever since its inception at the beginning of this century, and how these were met and what questions still await solution. The story of its gradual development from a small alcohol distillery and chemical factory into one of India's first-grade chemical and pharmaceutical enterprises makes interesting reading. The book is an economic study of

development of an important industry in western India, and, as such, it is sure to be of considerable interest to industrialists, business men, and economists in this country.

P. C. S. G.

## Abstracts from Reports

### ANNUAL REPORT OF THE EXECUTIVE HEALTH OFFICER OF THE CITY OF BOMBAY FOR 1939.

THE health conditions of the city during the year were decidedly better than what they were during the previous year. This fact may be judged from the total number of deaths which was 5,479 less than that registered in 1938. It is also noteworthy that the infantile mortality recorded during the year was the lowest since the year 1873. However, it was unfortunate that soon after the rains, the city was faced with the outbreak of malaria epidemic, especially in three wards, but the timely measures taken proved effective in controlling the disease within a short interval.

The number of live births registered was 37,822, being 1,074 more than in 1938 and 6,539 more than the average of the last ten years (1929-38). The birth rate calculated on the census population of 1931 was 32.6 births per 1,000.

The total number of deaths from all causes was 30,520, being 5,479 less than in 1938, 152 less than the average for the last five years (1934-38) and 2,260 more than that for the preceding decennium (1929-38). The death rate per 1,000 of census population of 1931 was 26.3 as against 31.0 in 1938 and 23.9 the rate recorded for the decennium (1929-38).

Thus the number of births during the year was more by 7,302 than the number of deaths. This excess of births over deaths was equivalent to 6.3 per 1,000 population calculated on the census of 1931 and was recorded nine times in succession. Before 1931 there was no such excess since 1866, the year in which birth records were instituted.

There was no death from plague during the year as against 20 the average of the last ten years (1929-38).

Smallpox caused 201 deaths as against 1,862 in 1938 and 1,067 the average for the last decennium (1929-38).

There was no death from cholera as against 1 in 1938. The average for the ten years (1929-38) was 19.

Influenza was prevalent in a mild form in the city during the year and caused 58 deaths as against 80 in the preceding year and 81 the average for the last decennium (1929-38).

The deaths from diseases of the respiratory system numbered 10,772 being 2,812 less than in 1938 and 586 more than the average of the last ten years (1929-38).

Tuberculosis accounted for 2,034 deaths as against 2,078 in 1938 and 1,741 the average for the preceding decennium (1929-38).

One hundred and seventy-one deaths were due to malaria, being 68 more than in 1938 and 56 more than the average of the last decennium (1929-38). There were 761 deaths from ague and remittent fever as against 1,065 in 1938. The average number of deaths for the last ten years (1929-38) from malaria was 115 and ague and remittent fever 1,337.

The deaths among infants under one year of age numbered 10,772, being 2,812 less than in 1938 and 586 average for the last ten years (1929-38). The rate of infant deaths per 1,000 births registered was 211.7 as against 267.0 for the preceding year and 258.6 the mean for the preceding decennium (1929-38).

Compared with the decennial average (1929-38) the total number of deaths shows an increase of 2,260, the principal increase in the mortality being 586 under respiratory diseases, 552 due to old age, 446 under

congenital debility and diseases of early infancy, 293 under tuberculosis, 127 under dysentery, 93 under diarrhoea, 56 under malaria, 31 under diphtheria and 26 under leprosy.

On the other hand there was decrease in the deaths under smallpox by 886, under ague and remittent fever by 576, under measles by 51, under diseases of nervous system by 33, under puerperal state by 30, under influenza by 23 and enteric fever by 10.

#### ANNUAL REPORT OF THE HEALTH OFFICER OF THE MUNICIPALITY OF GEORGE TOWN, PENANG (STRAITS SETTLEMENTS), FOR THE YEAR 1939

The most outstanding feature of this year's work was the increase in the number of cases of typhoid fever which assumed epidemic form at the end of August and beginning of September. Eight hundred and forty-eight cases of typhoid were notified during the year but death certificates were received for 4 more who were never notified. Five hundred and seventy-five cases were treated in hospital; 106 died and 469 recovered. Two hundred and seventy-seven cases remained at home; 46 died and 231 recovered. The total number of deaths was 152; the mortality rate was the greatest between the ages of 6 and 35, 15 deaths occurring between 36 and 45 years. One hundred and fifty-two deaths attributed to the enteric group was the highest recorded and an increase of 113 compared with 1938.

Detailed investigations carried out during this epidemic showed that the spread of the disease was through some ice-cream vendors, and one ice-cream factory had several employees who gave positive Widal reaction.

Readers interested in the details of this investigation might with advantage consult the original.

## Correspondence

### UNOFFICIAL QUALIFICATIONS

SIR,—May I request you to make a plea through your editorial columns for raising the standard of ethics observed by Indian medical practitioners? Complaints are being received in this country that impostors are freely using the letters F.R.C.S. or M.R.C.P. after their names with impunity; some are also using the letters M.R.A.S. (member, Royal Asiatic Society, I suppose!) which is neither a medical qualification nor a recognized diploma; and others are adopting various devices to disguise their qualifications and palming them off on the unsuspecting medical and lay public as diplomas granted by the University of London or the Examining Board in England.

Both by convention and long usage the medical and lay public have come to recognize certain well-known abbreviations used in the *Medical Register* (of Great Britain) and *Lancet* dated 31st August, 1940, as well as in the *Encyclopædia Britannica*.

Thus, F.R.C.S., F.R.C.S.E., F.R.C.S.I. stand for Fellow of Royal College of Surgeons of England, Edinburgh, and Ireland, respectively. Similarly M.R.C.P., M.R.C.P.E., M.R.C.P.I. stand for Member, Royal College of Physicians of London, Edinburgh, and Ireland, respectively. It appears that some Indians possessing diplomas of Edinburgh or Ireland feel ashamed to own their colleges and are resorting to the practice of omitting the E or I (as the case may be) when giving their diplomas, and are thus laying themselves open to the charge of dishonesty. Should the Royal colleges in this country decide to take disciplinary action, it may have far reaching consequences.

It also appears to me that the Secretary and Registrars of the various medical councils do not keep

themselves in touch with the examining boards in this country and consequently have been known to give wrong advice to candidates. Thus, in the Bombay Register it is stated 'the D.T.M. granted by the London School of Hygiene and Tropical Medicine...'. This school does not grant any diploma.

In recent numbers of the *Indian Medical Gazette* the names of two Indian doctors [we omit the names] are followed by the letters M.R.C.P. Neither is a member of the Royal College of Physicians of London and one does not appear to be a member of the Royal College of Physicians of Edinburgh, either.

It appears to me that on account of the exorbitant fees payable many doctors do not register their additional qualifications but contribute articles to medical journals merely to bring to the notice of brother practitioners their additional qualifications. The remedy to this state of affairs would be, (1) to reduce the fees for additional registration, or (2) to make compulsory registration of every additional qualification.

Editors of journals should also look up medical registers and verify the qualifications of contributors before publishing their articles. Articles by persons who put M.R.A.S. after their names would bring medical journalism into ridicule.

[Note.—The letter was signed by an Indian doctor at present resident in England, and was headed 'not for publication'.

Though this letter did administer a mild rebuke to us, we cannot conclude that this was the writer's sole object in sending it to us, and as he appeared to wish us to take up this cause, we feel that publishing the substance of his letter is perhaps the best way we can meet his wish.

Editors of medical journals have to take a great deal on trust; they cannot confirm all statements made by contributors. In the matter of his own qualifications, we usually accept the contributor's word, but we do very frequently, often by accident, find that they require modifying, particularly with reference to points noted by our correspondent.

The failure to add the specific 'E' or 'I' after R.C.P. or R.C.S. is probably the result of ignorance of the fact that leaving the college unspecified has any particular significance. The practice is not confined to individuals but is unfortunately common in official publications; here we must substitute the word 'carelessness' for 'ignorance'. We notice in a recently published provincial medical list, the original qualifications M.R.C.S. (Lond.) L.R.C.P. (Eng.)!

We feel that our correspondent's strictures are not entirely undeserved. We will try to do better in the future, and we hope that we shall receive better co-operation from both official and non-official contributors.—EDITOR, I. M. G.]

## Service Notes

### APPOINTMENTS AND TRANSFERS

ON return from leave Lieutenant-Colonel J. B. Hance, C.I.E., O.B.E., Residency Surgeon, Bangalore, assumed charge of the office of the Inspector-General of Civil Hospitals, C. P. and Berar, on the forenoon of 16th December, 1940.

Lieutenant-Colonel N. S. Jatar, C.I.E., D.S.O., ceased to hold the additional charge of the office of the Inspector-General of Civil Hospitals, C. P. and Berar, with effect from 16th December, 1940.

On reversion to military department Lieutenant-Colonel W. Ross-Stewart, C.I.E., Civil Surgeon, Lahore, made over charge of his duties on the afternoon of the 10th January, 1941.

Lieutenant-Colonel A. S. Garewal, Superintendent, Central Jail, Nagpur, has been appointed to officiate as Inspector-General of Prisons, C. P. and Berar, with effect from 18th January, 1941, *vice* Lieutenant-Colonel N. S. Jatar, C.I.E., D.S.O., granted leave.



Major S. Annaswami made over executive charge as Superintendent of Dum Dum Central Jail to Mr. W. F. B. Beale on the afternoon of the 11th November, 1940.

Major E. A. R. Ardeshir took over charge of the office of Superintendent of Rajshahi Central Jail from Dr. Abdul Majid on the forenoon of the 17th December, 1940.

Major W. McAdam assumed charge of the duties of Civil Surgeon, Tavoy District, on the forenoon of the 10th January, 1941.

Major S. Smyth assumed charge of the office of Civil Surgeon, Lahore, on the forenoon of the 29th January, 1941.

Major G. W. Miller is appointed to officiate as Assistant Public Health Commissioner with the Government of India, *vice* Dr. K. C. K. E. Raja granted leave.

The undermentioned officers of the Indian Medical Service are confirmed as Agency Surgeons, with effect from the dates shown against their names:—

Major E. A. O'Connor. Dated 10th November, 1940.

Captain J. D. Grant. Dated 15th November, 1940.

The services of Captain T. C. M. M. Morrison are placed at the disposal of the Government of Bombay for employment as Surgeon to H. E. the Governor of Bombay, with effect from the 1st June, 1940.

Captain C. L. Greening, an officer of the Medical Research Department, is appointed Assistant Director, Central Research Institute, Kasauli, with effect from the 27th November, 1940, on release from military duty.

#### LEAVE

Lieutenant-Colonel N. S. Jatar, C.I.E., D.S.O., Inspector-General of Prisons, C. P. and Berar, has been granted leave on average pay for 6 months, with effect from 18th January, 1941.

#### PROMOTIONS

##### *Captains to be Majors*

1st April, 1937

K. H. A. Gross, M.C., with seniority from 26th January, 1936.

P. J. Kelly, with seniority from 7th September, 1936. (Previous notification in so far as it relates to these officers is hereby cancelled.)

*Note.*—The promotion of the following officers to their present rank of Major is antedated as shown against their names:—

P. P. Chowdry, M.C. Dated 22nd May, 1937.

P. C. Dutta. Dated 25th May, 1937.

A. K. Gupta. Dated 15th January, 1938.

S. M. Kharegat. Dated 15th January, 1939.

B. N. Hajra. Dated 1st April, 1937, with seniority from 10th May, 1936.

A. A. Pullar. Dated 12th January, 1941.

*Notes (i).*—The promotion of Major C. F. J. Cropper is antedated to 8th August, 1937. He qualified for accelerated promotion on 18th July, 1939.

*(ii).*—The promotion of the following officer to his present rank of Major is antedated as shown below:—

N. J. U. Mather. Dated 18th March, 1938.

The undermentioned officer is granted the local rank of Captain without effect on pay and gratuity whilst employed at No. 1 Coy., I. H. C., Rawalpindi, in connection with the training of emergency commissioned I.M.S. officers and emergency Sub-Assistant Surgeons:—

Lieutenant H. L. Bhatia.

*Note.*—The seniority of Captain P. M. Kaul in his present rank is antedated to 26th May, 1934.

#### RETIREMENTS

Lieutenant-Colonel J. M. Shah, M.B.E. Dated 17th January, 1941.

Lieutenant-Colonel R. H. Malone. Dated 19th January, 1941.

Lieutenant-Colonel P. Verdon. Dated 22nd February, 1941.

## Notes

### MYOCRISIN

A copy of the second edition of a booklet on Myocrisin has been sent to us by the makers, Pharmaceutical Specialities (May and Baker), Limited, Dagenham.

Myocrisin is sodium aurothiomalate, a compound with a gold content of 50 per cent which has been found valuable in the treatment of rheumatoid arthritis and other conditions, effecting complete cure in 50 per cent of the cases treated in the early stages. In the later stages where the condition is of long standing Myocrisin has been found to arrest the progress of the disease, increasing movement and reducing pain.

Copies of this booklet, which contain full information on the application of Myocrisin in the various conditions for which gold therapy is indicated, may be obtained by members of the medical profession on application to May and Baker (India), Limited, 11, Clive Street, Calcutta.

## Publishers' Notice

SCIENTIFIC Articles and Notes of interest to the profession in India are solicited. Contributors of Original Articles are entitled to receive 25 reprints *gratis*; additional reprints can be obtained on payment. No reprints will be supplied unless contributors *ask for them at the time of submitting their manuscripts*.

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## Original Articles

## FRACTURE OF THE CARPAL SCAPHOID

By C. J. HASSETT

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FRACTURE of the carpal scaphoid is the commonest injury of the carpal bones. It is more commonly diagnosed as a sprained wrist which is a very uncommon injury. In all fractures and sprains treated in the civil and Tochi Scouts hospitals in the past year the condition occurred only once. There were 28 fractures of the carpal scaphoid in a series of 116 simple fractures treated in both hospitals in the past eight months.

The anatomy of the bone with special reference to the blood supply has been well described by Oblatz and Halbstain (1938). In their paper, it is shown that in 13 per cent of the navicular bones studied by them there was no apparent blood supply proximal to the constricted mid-portion or waist, in 20 per cent there was a single small arterial foramen at the waist or proximal to it, and in 67 per cent there were two or more foramina proximal to the waist. Therefore, it may be seen that fractures through the constricted portion cause a severe interference of normal blood supply to the proximal fragment and in at least 13 per cent of the cases a total interception in the nutrition of this part.

These facts explain the unequal rate of union in fractures of this bone and the occurrence of avascular necrosis which will give rise, if not dealt with, to osteo-arthritis of the wrist joint. The bone may be fractured at any one of three levels: (1) the tubercle, (2) the waist, or (3) the proximal pole (*vide* figure 6). The most common injury is fracture of the waist.

The mechanism of the injury is stated to be a fall on the outstretched hand, but in our experience the fracture appears to occur with the hand outstretched and dorsiflexed or clenched in dorsiflexion in a position of radial deviation, the force giving rise to a screw movement compressing the bone between the greater and lesser multangular bones and the distal articular surface of the radius. The main strain then falls on the scaphoid causing it to fracture. There may be associated with it dislocation of the semilunar and it may complicate Colles' fracture.

As remarked previously, it is frequently overlooked, the symptoms being attributed to simple sprain of the wrist, a rare condition. Clinically there is tenderness in the anatomical 'snuff-box' which is obliterated by swelling in recent fractures. There is limitation of movement of the wrist joint, particularly dorsiflexion, and there is weakened hand grip. X-ray diagnosis requires extreme care. Radiographs should

always be taken in three planes—antero-posterior, lateral and the more important oblique view—which shows the bone in more accurate detail, that is, with the x-ray passed through the wrist at a 45° angle to the carpal plane.

Many fractures of this bone are overlooked radiologically because the fracture line is often hardly discernible. In the study of the film a magnifying glass will show evidences of pathology. If there are negative x-ray findings and the clinical signs are in favour of fracture, a repeat x-ray must be carried out one to two weeks later, when evidence of fracture will be present (*vide* plate X, figures 1 and 2). Movements of the bone causing hyperæmia and decalcification at the site of injury make the line of fracture quite clear. As a general rule, the clinical signs are more reliable than the x-ray findings.

In old or neglected fractures the fracture line develops a decalcified and cystic appearance, as may be seen from plate X, figure 3. When this cystic gap is well defined, the fracture is several months old. If the fractured surfaces are densely calcified and sclerosed the injury is generally over a year old. The treatment of recent scaphoid fractures is simple, provided accurate and continuous immobilization is properly carried out. The position of the bone, half in the proximal row and half in the distal row of the carpus, and the fact that the fracture line usually coincides with the line of the mid-carpal joint, make it very liable to shearing strains. A closely-fitting unpadded plaster cast must be used, the plaster extending from the metacarpal heads to below the elbow joint. On the radial side it includes the first interosseous space and the whole of the first metacarpal. The wrist is in a position of slight dorsiflexion and ulnar adduction, i.e., the position of grip. On the palmar surface the plaster extends as far as the first palmar crease. These splints are more conveniently made from strips of lint so cut and fashioned to suit the limb. They are then soaked in plaster cream until thoroughly saturated. They are then applied and covered with one plaster bandage. The whole gives a light and durable plaster cast.

How long should recent fractures be immobilized? In our series the average period was 8 weeks and the maximum 12 weeks. The fracture is immobilized until there is accurate x-ray evidence of union. After removal of the plaster the best clinical sign is return of the hand grip to normal. Finally, the wrist must be radiographed and a lens is again used in the examination of the radiograph to determine the presence of bony trabeculae growing across the fracture line. If after the removal of the plaster clinical and x-ray signs show that the fracture is united, the plaster should be re-applied for a further two months and union is again tested as previously described.

Active movements of the finger should be carried out from the onset. The patient should



be encouraged to carry out his duties as far as possible. Where it is necessary to maintain immobilization for longer than normal, the wrist may be stiff after the removal of the plaster. Active movements and massage are given. If improvement does not occur the joint should be manipulated under anæsthesia followed by massage and active movements. This was necessary in one case where the wrist was immobilized for 12 weeks. He subsequently obtained a perfect result.

In neglected fractures the treatment adopted is similar to the above. This is the fracture which shows cystic spaces and decalcification along the line of fracture in the radiograph. Immobilization must be continuous and prolonged. It usually takes several months before union is secured. In cases of established non-union, that is, fractures of over one-year old and which show filling up of the cystic spaces, recalcification and sclerosis, prolonged immobilization will be unsuccessful and operative treatment is necessary.

This consists in multiple drilling. The tubercle of the scaphoid is exposed and by means of a fine drill multiple drill holes are driven across the fracture, taking care not to damage the articular cartilage. The indications for this are rare. In our series avascular necrosis occurred in two cases (*vide* plate X, figure 4). This condition occurs as a result of interference with the blood supply following the fracture. It is evidenced in the radiograph by the absence of decalcification of the proximal fragment which shows up in the x-ray to be much denser. This will be evident after the removal of the plaster when the radiograph is examined. The treatment of this condition is excision of the avascular fragment, otherwise osteo-arthritis of the wrist joint or midcarpal joint will supervene, even though the fracture is treated by prolonged immobilization and union is eventually secured.

Excision of the avascular fragment gives complete relief from pain and limitation of movement but there is some weakness of the hand grip. In the two cases where this operation was carried out, the individuals are carrying out full duties as Scout sepoy (*vide* plate X, figure 5).

The operation is performed through an incision made on the outer side of the extensor pollicis longus tendon in the anatomical snuff-box. The radial artery is displaced and the radial collateral ligament split. The bone is brought into view by ulnar adduction of the hand; the proximal necrosed fragment is identified and removed.

In cases where osteo-arthritis has supervened, *i.e.*, in neglected fracture of many years' standing, excision of the fragment is useless. It is necessary to arthrodesis the wrist in the optimum position. This is carried out by a dorsal incision from the base of the third metacarpal to the lower end of the radius. The periosteum is incised and elevated over the lower end of the

(Continued at foot of next column)

## SURGICAL COMPLICATIONS OF FILARIASIS

By P. N. RAY, B.A., M.B., F.R.C.S. (Eng.)

Calcutta

NEXT to malaria, filarial infection is probably the most widespread disease in certain parts of India, although the rate of mortality is not as high as in malaria, the amount of disability and suffering is enormous. Not being one of the fashionable diseases, it has not received in this country the amount of attention which is justly its due.

### Classification of surgical complications

Before proceeding any further, it will be helpful, if we briefly refer to a practical scheme of the surgical complications.

#### 1. Inflammatory:

- |   |                           |
|---|---------------------------|
| Acute:                                    | Chronic:                  |
| (i) Lymphangitis.                         | (i) Focal spots.          |
| (ii) Elephantoid fever.                   | (ii) Fibro-myositis.      |
| (iii) Funiculitis and epididymo-orchitis. | (iii) Epididymo-orchitis. |
| (iv) Lymphadenitis.                       | (iv) Hæmato-spermia.      |
| (v) Cellulitis and abscess.               | (v) Sterility.            |

#### 2. Obstructive:

- |   |  |
|---|--|
| (i) Elephantiasis of limbs.   | (v) Elephantiasis of penis and scrotum, and vulva. |
| (ii) Hydrocele, chylocele, and hæmatocele.  | (vi) Chyluria.                                     |
| (iii) Lymphatic varix of the cord.  | (vii) Lymph-scrotum.                               |
| (iv) Varicose lymphatic glands, inguinal lymph varix and lymphatic varix of broad ligament. |  |

#### 3. Allergic:

- |                |                       |
|----------------|-----------------------|
| (i) Urticaria. | (iii) Filarial fever. |
| (ii) Pruritus. |                       |

(Continued from previous column)

radius and the third metacarpal. A gutter is prepared and a bone graft removed from the tibia inserted into the prepared bed. Union is secure in about four months. The wrist joint is of course stiff, but there is not the disability one would expect.

### Summary

Fracture of the carpal scaphoid is a relatively common injury while sprain of the wrist is rare. With adequate treatment union is certain. Without treatment there is persistent weakness of the hand grip and all movements of the wrist are restricted. Where avascular necrosis of the proximal fragment occurs, it should be excised. In both the cases in which it was carried out a good result was obtained.

I am grateful to F./Lieut. K. R. Butler, R.A.F., for assistance with the x-ray photos and to Colonel W. C. Paton, M.C., I.M.S., inspector-general of civil hospitals, North-West Frontier Province, for permission to publish this article.

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STEIN, B. M. (1938). 424.

PLATE X

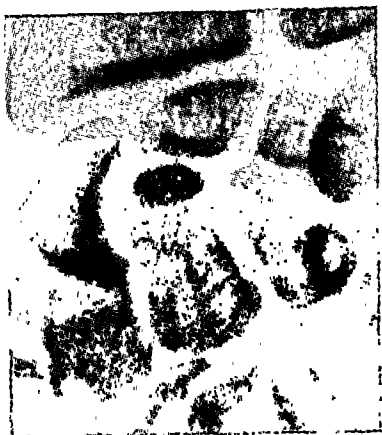


Fig. 1.—No evidence of fracture.



Fig. 2.—Same case as fig. 1 week later showing crack fracture.

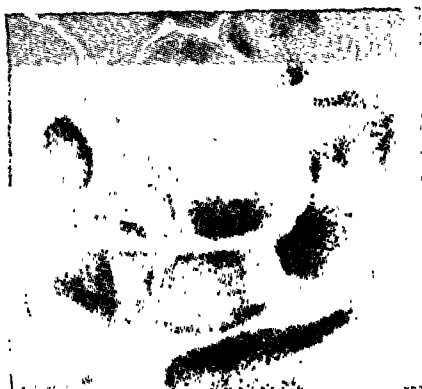


Fig. 3.—Old fracture showing decalcified and cystic appearance.



Fig. 4.—Fracture showing avascular necrosis of the proximal fragment.

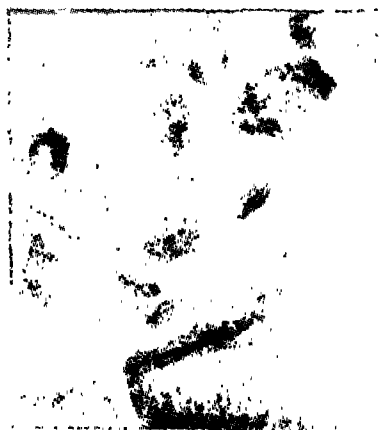


Fig. 5.—Post-operative result after excision of avascular proximal fragment.

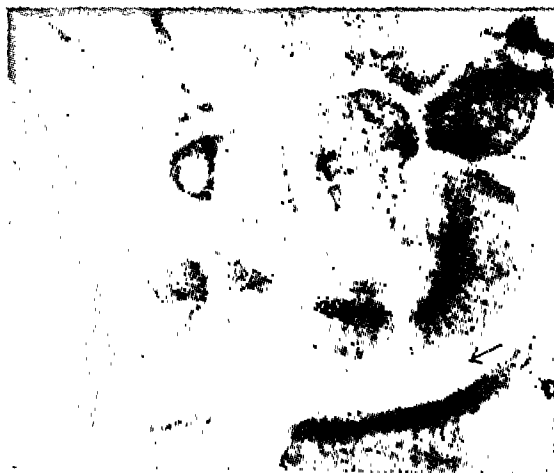


Fig. 6.—Fracture of the proximal pole.



Fig. 1.



Fig. 2.



Fig. 4.



Fig. 5.



Fig. 3.

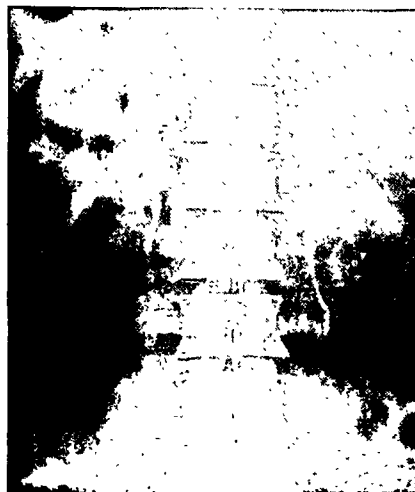


Fig. 6.



Fig. 7.

#### 4. Carriers:

This is a useful classification, but it is important to note that generally there is considerable overlapping of different lesions.

#### Pathological findings

*Normal habitat of the adult worm.*—The filarial worm (*Wuchereria bancrofti*) in its adult or mature state is an inhabitant of the lymphatic system of man. After the larvæ gain entrance into the human body they usually complete their development in the afferent lymphatics, but some of them may develop in the vicinity of their point of entrance. Filarial infestation may, therefore, be regarded as a specific affection of the lymphatic endothelium due, either to the toxin of the adult parasites, or to the damage caused by the passage or presence of the immature larvæ, or by the adult parasites. This view is supported by the following facts: (1) the occurrence of primary elephantiasis in filarial subjects without lymphangitis, (2) the severe general reactions of the acute filarial attack, and (3) the immunity to filarial toxin of sufferers from malaria. Romiti (1935) has sponsored the theory of the completion of the parasitic cycle in the genital lymphatic system. According to him the different stages of infection are the result of the emigration of the adult worm from its normal habitat or its development elsewhere than in the genital tract. There are many cogent objections to this view. After an infective larva has entered the subcutaneous tissue space, it has two vehicles of dissemination (Lane, 1931). If it enters a lymphatic vessel it may come to a stop somewhere in the slow lymph current and then grow to maturity. If it enters the blood current it may make an extensive tour within the body. It is at once taken to the right heart, and thence to all parts of the body through the arterial circulation. If the capillary to which it is taken is found to be suitable, it makes its way through the wall into the surrounding tissues and finally into a lymph vessel to undergo maturity. If the larva fails to reach a suitable spot, it dies. The objection has been offered that the filarial larva is too large for the capillaries.

*Changes in the lymphatic vessels and glands: Effect of living parasites on the tissues.*—Evidence has gradually accumulated that adult parasites may live in numbers in the smaller lymphatics of the limbs and on the distal side of lymphatic nodes. The constant passage of microfilariae will ultimately induce considerable cellular reaction in them. Dilatation of the infested lymph vessels is an early change, but varicosity and hypertrophy are not met with until the occurrence of obstruction at a higher level. In regions of low endemicity the larvæ may pass through the lymph glands of the limbs and may reach the pre-aortic group or even the cisterna chyli, and the resulting obstruction may give rise to hydrocele of the vaginal sac, lymph varix of the spermatic cord,

chylocele and chyluria. But in hyperendemic regions, the first glands (*viz.*, inguinal) through which the larvæ pass are subjected to repeated traumata and are severely damaged; this results in elephantiasis of the lower limbs. In elephantiasis of the scrotum and penis, the site of obstruction is in the pelvic and iliac group of lymphatic glands.

*Obstruction to lymphatic glands by parasites.*—It is now clear that adult parasites may cause mechanical and inflammatory obstruction to the onward flow of lymph, as a result of which, either lymphatic varices or lymphatic œdema, or both may be set up. Owing to the existence of extensive anastomosis of lymph channels, compensatory lymphatic circulation is generally established within a short time. But before this can occur, it is necessary that there should be first an increase in the lymph pressure and dilatation of lymph vessels in the neighbourhood of the block. It has been found that about 75 per cent of adult filariæ are present in dilated lymph vessels round the gland or in the capsule and the cortical sinuses of the glands. The glands containing adult parasites may show considerable enlargement owing to the formation of eosinophil granulation tissue followed by fibrosis around the parasite.

*Changes round dead parasites: Chronic epididymo-orchitis.*—When the parasite dies a remarkable set of reactions takes place round it, and these changes are best seen in chronic epididymo-orchitis (Ray, 1934a). The epididymis is much more enlarged than the body of the testis. If the specimens are removed before midday, numerous microfilariae are also seen within the uterine cavity of the living parent worm (plate XI, figure 1). The epididymis presents a mass of necrotic hyaline-like material in which sections of degenerating parasites can be identified (plate XI, figure 2). This area is surrounded by a zone of round-cell infiltration with some admixture of plasma and eosinophil cells and foreign-body giant cells (Ray, 1934). The presence of eosinophil cells is most marked near the vulval end of the worm. The sections through the body of the testis show scattered areas of round-cell infiltration with a varying number of plasma cells and fibroblasts in the interstitial tissues and in the neighbour-

#### DESCRIPTION OF PLATE XI

- Fig. 1. Showing section of an adult female filaria in a dilated lymphatic of the testicle. Note the microfilariae contained within the uterus.
- Fig. 2. Showing section of dead and degenerating adult filaria in the epididymis.
- Fig. 3. Skiagram showing calcification of dead worm in a case of elephantiasis of the leg.
- Fig. 4. Cystoscopic appearance of bladder showing masses of coagulum mostly fibrin.
- Fig. 5. Cystoscopic appearance of bladder showing the emergent clot at ureteric orifice.
- Fig. 6. Excretion urography showing radiating fibrils round the kidneys and bilateral ureteral kinks.
- Fig. 7. Excretion urography showing displacement and kink of the ureters. Note also the radiating fibrils round the kidney.

hood of the seminiferous tubules. The remains of the dead worm are shut off like a foreign body in a mass of hyaline-like material (O'Connor, 1932). Eventually the whole area may become fibrosed. Local endo-lymphangitis obliterans with dilatation and hypertrophy of the muscular coat is also generally noted. The fate of such a testis may be fibrosis, degeneration and supuration. Calcification of the dead worms (plate XI, figure 3) is not uncommon.

*Other genital lesions in filarial infection.*—The pathological changes associated with lymphatic stasis, œdema and elephantiasis may now be understood. It is, however, important to note why adult filariæ should be present in the spermatic cord and the epididymis in such large numbers. It appears that as a result of lymphatic blockage at a higher level, e.g., the pre-aortic group of lymphatic glands and cisterna chyli, aberrant migration of adult worms takes place into these organs. The most striking feature in chyluria is the enormous dilatation of the regional lymphatic trunks, which may be regarded as an imperfect attempt at the formation of an effective collateral circulation after obstruction to the cisterna chyli and thoracic duct. The earliest manifestation of genital filarial involvement consists of œdema in the connective tissue of the spermatic cord and the gubernaculum of the testis in the male, and the broad and ovarian ligaments in the female. The latter condition is frequently associated with dysmenorrhœa and premenstrual pain. Elephantiasis of the female external genitalia is comparatively rare. The extreme rarity of genital elephantiasis in childhood is possibly due to the absence of vascularity of the parts and their non-development before puberty (Ray, 1936).

*Super-added or secondary infection.*—There is little doubt that the recurring attacks of lymphangitis are primarily due to the adult parasites. The hypothesis of 'streptococcal latency' is a less satisfactory explanation of recurrent filarial lymphangitis than one based on a tuberculin-like allergy of the affected tissue resulting from numerous minor infections. Pyogenic organisms are only present as a superadded or secondary infection. The most typical instance of bacterial invasion is furnished by acute orcho-funiculitis and streptococcal septicæmia associated with filarial orchitis. The association is explained as possibly due to an upset symbiosis or to some condition of 'soil' produced by the parasites, which is suitable for the streptococcus.

#### *Inflammatory conditions in filariasis*

*Acute conditions:* (i) *General.*—All the acute inflammatory conditions are accompanied by high pyrexia and some focal manifestations, but these tend to become recurrent with gradual amelioration of symptoms. The lymphangitis may closely simulate erysipelas. Inflammation and suppuration are common in filarial genital

lesions because of the liability of the parts to chaffing, intertrigo, impetigo, etc.

*Treatment.*—In high pyrexia, Prontosil rubrum (intramuscular injections, combined if necessary with oral administration of tablets) generally gives dramatic results. Prompt local relief is obtained by elevation of the limb and application of hot fomentations (Ray *et al.*, 1938). Both short-wave diathermy and infra-red therapy are found to be beneficial. A secondary streptococcal septicæmia proved in the past to be very fatal but the prognosis has greatly improved with modern chemotherapy with sulphanilamide preparations.

(ii) *Recurring lymphangitis and pyrexia.*—It is usual to classify attendant pyrexia into two groups: one with a focal exacerbation may be called *elephantoid fever* and the other due to allergy, *filarial fever*. The latter may not be allergic in origin at all, but may be due to a cryptic reaction, as, for instance, in a deeply seated or inaccessible region.

*Treatment:* (a) *Change of climate.*—Migration to a colder climate seldom fails. It is probable that, on account of the cold acting from the outside, a general vaso-constriction takes place, involving all the peripheral vessels and lymphatics. This leads to increased blood and lymph flow in deeper tissues and organs. As a result, the parasites are dislodged from their habitat, with marked attenuation of allergy.

(b) *Pyro-therapy.*—Induction of pyrexia as a therapeutic measure may be obtained by several methods, either separately or in combination, viz, physical methods, non-specific protein and vaccine therapy and inoculation of pyrogenetic diseases.

*Physical methods.*—Recent methods include the use of powerful short-wave diathermy current and an electrically heated cabinet to raise the body temperature to 105°F. In suitable cases physical methods may be used in conjunction with the methods described below.

*Non-specific protein and vaccine therapy.*—Little need be said about milk protein preparations like 'Aolan'. Its exact mode of action is not clear, but it is presumed to be due either to the effects of induced pyrexia or to a cellular reaction—focal or general. Sulphosin, a colloidal sulphur preparation in oil, has been used in doses of 2 to 5 c.cm. for intramuscular injection with a varying amount of success. Special vaccines like T. A. B. do not act specifically (Banerjee and Basu, 1927). Dmelcos vaccine, given intravenously in doses of 0.5 c.cm. increasing to 2 c.cm., is also useful for the induction of controlled pyrexia.

*Induced malaria.*—For this purpose benign tertian malaria is preferable to quartan malaria, or simian malaria (*Plasmodium knowlesi*). Very great care is necessary for the selection of the cases, donor and the technique of inoculation. Generally 3 c.cm. of the donor's blood is injected intravenously; there is an incubation period of

about seven days. It is necessary to allow the temperature to rise to 105°F. In the absence of any contra-indications, induced malaria appears to be an effective therapeutic measure. But further experience is necessary before it is possible to give a final opinion regarding the height and duration of pyrexia necessary for the certain destruction of the parasites.

(c) *Allergen therapy*.—A titrated preparation of filarial hydrocele fluid has been used (Goyal and Rao, 1940); it contains a certain amount of antigen, derived either from the adult parasite or microfilariae. Further work might be carried out on this subject, in comparing the antigens derived from microfilariae and adult parasites.

(d) *Drugs*.—There are no specific drugs. In many cases, 'arseno-typhoid' (Banerjee) brings about a cessation of recurrent attacks of pyrexia. It has been shown by a series of electro-static experiments that certain bacteria, e.g., *Bacterium typhosum*, *B. coli*, etc., adsorb definite quantities of such elements and compounds as arsenic, arsenic sulphide, etc. The quantity of the adsorbed chemicals has been estimated gravimetrically and their toxicity assayed on animals (Banerjee and Basu, *loc. cit.*). It is probable that when the impediment to lymphatic flow is caused by a local inflammatory cellular reaction, stasis and oedema, without permanent fibrocytic changes, it may be relieved by therapeutic measures. Tryparsamide (May and Baker) has also been used.

(iii) *Acute funiculitis and epididymo-orchitis*.—These are usually accompanied by well-marked general and constitutional disturbances and formerly had a high rate of mortality. General treatment with 'Prontosil' and allied sulphanilamide drugs has proved to be very effective (Ray *et al.*, 1938). The attacks may completely subside, but terminal abscesses requiring surgical interference may form.

*Chronic conditions*.—Of these focal spots, fibro-myositis and chronic epididymo-orchitis require mention. In recurrent attacks of elephantoid fever or lymphangitis, maximum pain or tenderness may be referred to certain definite parts of a particular limb. On examination, small nodules or indurated areas may be located, e.g., in the calf muscles. On skiagraphy, calcified worms (plate XI, figure 3) and diffuse shadows may be seen. In cases of recurrent attacks, the focal spot is best dissected out. A localized area of fibro-myositis may be treated with diathermy and electro-therapy with the faradic current. In suitable cases of chronic epididymo-orchitis with recurrent attacks of pyrexia, epididymectomy is indicated, but in cases of massive enlargement without elephantiasis of the scrotum, orchidectomy is best performed. Sterility is usual in bilateral cases.

#### *Obstructive conditions in filariasis*

(a) *Hydrocele, chylocele, and hæmatocele*.—In bilateral cases, a median incision through the scrotal raphe provides a satisfactory approach.

In small and single hydrocele an inguinal incision is to be preferred. The problem of eversion of the sac or excision is decided mostly on individual preference. Unless the skin is definitely thickened, partial excision of the skin does not in the long run yield the best results. For one thing, post-operative oedema may be troublesome, and, for another, lymph scrotum may follow as a complication. The explanation lies in the fact that the main lymphatics of the scrotum run on either side of the median raphe. Needless injury or destruction results in further lymphatic obstruction.

(b) *In elephantiasis of the penis and scrotum*.—Excision of the elephantoid skin and, when necessary, skin grafting should be done at the same time. Many modifications are practised but Thiersch's graft is, in the majority of cases, satisfactory.

(c) *Lymph scrotum*.—This may be very distressing; the discharging fluid may be clear or chylous, and may amount to several ounces in 24 hours. No operative treatment should be undertaken until the discharge has stopped. Absolute rest in bed, elevation of the scrotum, application of lotio calaminæ, omission of fat in the diet, and mild purging are generally prescribed. The operative treatment is similar to that of scrotal elephantiasis.

(d) *Chyluria*.—It is of interest to note that chyluria is a feature of filarial lesions in some infected localities, e.g., in the United Provinces, with low filarial endemicity. It is comparatively rare in hyperendemic areas like Cochin and Puri. It has already been noted that in regions of low endemicity the larvæ pass through the regional lymphatic glands in the limbs and may reach the pre-aortic group or even the cisterna chyli, which they damage, and the result is lymph varix of the cord, hydrocele, chylocele and chyluria. The essential pathological lesions consist of obstruction to the regional lymphatic systems, and even the cisterna chyli and the thoracic duct. The pathological changes in the urinary tracts are not constant. In one variety the cortex of the kidney appears swollen and soft with the pyramids standing out as clearly-defined areas; in the other variety, definite fibrotic changes are seen. Obstruction of the thoracic duct or the cisterna chyli does not invariably lead to the rupture of the varicose lymphatic trunks into the urinary tracts. In the most serious type of hæmato-chyluria, there appears to be a generalized lymphangiectasis with incompetence of the lymphatic valves, allowing a direct flow of blood from the subclavian vein (Ray and Rao, 1939).

Some biochemical aspects of chyluria may be noted. There is a great variation in the fat and albumin content of the urine, varying from a trace to 1.1 per cent in the case of fat and from nil to 0.6 per cent in the case of the albumin. Fibrin is frequently present in the specimen collected after the midday meal. Many interesting facts are observed on the

effect of diet containing different fats, or the excretion rate of the fat in the urine. It is worthy of note that in filarial infection the blood cholesterol content is increased. The maximum noted was 0.220 and the minimum was 0.12 per cent with an average of 0.146 per cent as against the normal average of 0.116 per cent.

The mode of onset of chyluria is spontaneous, but in nearly half the cases a history of injury of some sort is forthcoming. In females, it appears to date from a parturition. In another type of case, the history is obtained that it followed a rich meal.

*Investigations: Cystoscopy.*—To be of value it should be performed during the flow of chyle. In about 70 per cent of cases the point of leakage is easily seen in the bladder, usually just above the ureteric bar of Mercier, but less commonly below it within the trigone. The bladder is sometimes filled with masses of coagulum, mostly fibrin (plate XI, figure 4). In about 25 per cent of cases, the chyluria is of renal origin, and a characteristic efflux or an emergent clot may be seen at the ureteric orifice (plate XI, figure 5).

*Excretion urography.*—With the aid of excretion urography, usually, but not in every case, a communication between the renal calices and the dilated perirenal lymphatics is clearly displayed by the presence of delicate fibrils radiating from the kidneys (plate XI, figure 6). In nearly half the cases of renal chyluria some obstruction to, or displacement of, the ureters is demonstrated (plate XI, figure 7).

*Treatment.*—No prophylaxis is of any avail.

(i) General treatment: This consists of complete rest in bed, elimination of fat from the diet, aperients and elevation of the foot end of the bed. This simple treatment may abort an attack if promptly carried out. There are some practitioners who prefer to give an additional amount of fat in the diet in order to compensate for its loss in chyluria.

(ii) Operative cystoscopy and ureteral diathermy: Operative cystoscopy and fulguration are successful when the leakage is slight. If clots are present, a previous bladder irrigation with 1/2,000 silver nitrate solution would be useful. Ureteral diathermy is successful in a small percentage of cases of chyluria of renal origin.

(iii) Other measures. A successful lymphatico-venous anastomosis would provide a satisfactory short-circuit for the obstruction to the cisterna chyli or the thoracic duct but has not been a surgical success.

(e) *Inguinal and spermatic lymph varices.*—The lymphatic varix of the cord is often mistaken for either a bubonocoele or a hernia, and generally excised during the operation. Occasionally an intractable chylous fistula may develop. In some cases injection of a 10 per cent solution of sodium morrhuate gives excellent results. The same treatment is preferable in varicose lymphatic glands.

(f) *Elephantiasis of limbs.*—The surgical treatment of this condition has not proved to be satisfactory owing to the difficulty of establishing an efficient alternative lymphatic drainage.

*Treatment: Non-operative.*—In milder cases elastic bandages and supports, elevation of the limb, e.g., resting the leg upon a chair at frequent intervals, vibro-massage and faradic currents, separately or in suitable combinations, are found to be fairly satisfactory. Pyrotherapy and medicinal treatment have already been discussed, and in early cases these have proved to be of value.

*Operative.*—The main surgical problem is the relief of serious lymphatic obstruction.

(i) *Modified Auchincloss operation* is a plastic operation, involving removal of infected areas and blubbery tissues. In the first place, an attempt is made to remove areas that the patient has come to recognize as the starting point of painful attacks. Calcified dead worms and other 'focal spots' are also removed by means of elliptical incisions. This operation requires very delicate technique. The raising of the flap of skin demands great care and experience. The location of the diseased areas, in spite of previous skiagraphy, is not always easy.

(ii) *Gluteal-femoral plastic operations.*—This operation involves a very delicate technique into which we need not now digress. A large flap of skin is raised from the gluteal region containing a generous supply of fatty tissues and, if necessary, part of the deep or gluteal fascia. A similar flap is raised from the femoral region. The gluteal flap is brought round and planted into the femoral bed and the latter flap is grafted into the gluteal region. The object is to divert the lymphatic trunks of the lower limb into the gluteal region and develop an efficient anastomosis for the drainage of lymph *via* the axillary and neighbouring lymph channels.

In many cases a combination of these two operations is likely to give satisfactory results, but further experience is necessary.

(iii) *Kondoleon's operation.*—This has not proved to be successful and the relief obtained is rarely permanent.

(iv) *Lymphatico-venous anastomosis.*—Attempts have been made from time to time to make a lymphatico-venous anastomosis. Transplantation of dilated lymphatics into a neighbouring vein of a large size has been suggested, but surgically it is seldom feasible. Anastomosis between a varicose lymphatic vessel and its companion vein has not been a surgical success.

*Drug prophylaxis.*—No drug has yet been obtained which will satisfy the following requirements: (1) harmless to the host, (2) effective and selective parasiticide and (3) excreted into the lymphatic system. We are looking for a drug to satisfy all these points. Under medical treatment we have discussed the value of certain drugs.

(Continued at foot of next page)



## 'XIPHISTERNAL ACHE' OR LOW SUBSTERNAL PAIN

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PAIN in the chest is quite frequently the presenting symptom in cases of heart disease. Little importance was however attached to this symptom till 1786, when Heberden presented the medical profession with a masterly description of angina pectoris. Since that time, much has been written, mainly of a controversial nature, on the ætiology, diagnosis and treatment of anginal pain. The passage of time has also served to separate pains of lesser or no significance, such as pseudo-angina or 'angina innocens' (Bourne, 1937) from true angina. In spite of the massive literature existent on the subject, at the present day, it is very probable that the subject of heart-pain has by no means been exhausted or explained.

Though atypical forms of heart-pain have figured in past medical literature, they have not received the attention they deserve; nor has any serious attempt been made to arrive at a classi-

(Continued from previous page)

**Conclusion.**—In a brief review, I have made an attempt to present a clear picture of the filarial problem from the surgeon's point of view, but in reality the problem cannot be subdivided into surgical and medical aspects. In many respects it resembles that of malaria and thus preventive measures are the most important (Ray, 1940).

**Acknowledgments.**—I wish to acknowledge my indebtedness to my numerous colleagues during many years of co-operation. I wish to offer my grateful thanks to Professor C. C. Bose and Dr. D. N. Banerjee of the Carmichael Medical College, Colonel Sir R. N. Chopra, Kt., C.I.E., I.M.S. (Retd.), and Dr. S. Sundar Rao of the School of Tropical Medicine and my colleagues and house staff in the Calcutta Medical College.

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fication or clarification of this complex subject. It is possible that, with a growing knowledge of the subject, we may be able to recognize and distinguish different varieties of heart-pain by their clinical characteristics. Attempts in this direction have actually been made in recent years. Thus, German workers (Frank and Worms, 1926) have tried to differentiate true angina or angina of coronary origin from aortalgia or angina of aortic origin; such a view, if substantiated, is likely to modify to a considerable extent our present-day views on the causation of angina pectoris.

A study of the files of cardiac patients, both in private practice and in the out-patient department of the Liverpool Heart Hospital, has brought to my notice seven cases of heart-pain with features sufficiently unusual to warrant attention. While distinct in several respects from the generally recognized forms of cardiac pain (such as angina pectoris and benign cardiac pain), these cases are clinically strikingly similar, a fact which suggests the possible existence of yet another form of heart-pain. My attention was first drawn to this form of pain by two cases (cases 6 and 7 reported here) of atypical chest pain, seen within the space of a few weeks, in Liverpool. A look-out for further cases of this nature in India has been rewarded by the finding of five more cases.

In order to stress the two main characteristics of this variety of pain (*viz.*, the site and character of the pain), the designation proposed for it, as being the most suitable, is 'xiphisternal ache' or, alternatively, 'low substernal pain'. Patients, who were subject to typical attacks of angina pectoris as well as the type of pain described here, had little difficulty in distinguishing between the two types of attacks.

### Case reports

**Case 1.**—A Parsee gentleman, aged 73, was seen in May 1939 with a few months' history of shortness of breath on exertion and attacks of giddiness; the latter symptom was usually induced by change of posture, such as bending forwards. For a few months, he had been subject to attacks of pain at the lower end of the sternum; they were usually noticed at about 4 o'clock in the afternoon and also at other times, when he was particularly tired or depressed; in his opinion, the attacks bore no relation to exercise or meals. Pain would start in the region of the xiphisternum, show a gradual increase in intensity and after a period of 'about an hour' would 'work itself off' without any treatment; alkalies were of no avail, though feeling 'depressed and shaken' the patient could carry on with his work as usual, even during the attacks.

On examination, he was thin and sparse, but highly energetic. Pulse rate was 78 per minute; pulse regular and of good volume. Blood pressure was 172/102.

The cardiac impulse was 'heaving' in character and situated in the 5th space, 4 inches from the mid-line. The first sound at the apex was prolonged and thudding in character, while the 'aortic second' was loud and ringing. No murmurs were audible.

Fluoroscopy revealed a dilated aorta (transverse diameter: 8 cm.) with a very prominent 'aortic knuckle' and moderate enlargement of the left ventricle.

After five months of treatment on a sedative mixture and 'jocapral' tablets, the patient was seen again; there was considerable relief from dyspnoea and vertigo,

while attacks of pain no longer occurred. His blood pressure, at the time, was 160/92.

**Case 2.**—A Parsee gentleman, aged 63, was seen early in 1939 with a history of several years of 'heart trouble'. For years he had been the subject of leucoderma. In 1927, he had an operation, in England, for pain, and paræsthesia and weakness of the lower extremities; a bony tumour was removed from the fourth lumbar vertebra with subsequent disappearance of symptoms. In 1933 he developed severe pain in the præcordium with dyspnoea and collapse, later diagnosed as 'coronary thrombosis'. Since that time he had experienced dyspnoea on effort, headaches, palpitations and throbbing in the neck and chest. He had also been subject to attacks of pain in the region of the xiphisternum; they would last for five to fifteen minutes with no tendency to radiate in any direction or cause constriction; the attacks would arise spontaneously with little or no relation to effort or emotion; the pains, which were infrequent, were of moderate intensity and did not incapacitate the patient in any way. The xiphisternum would feel sore for some time after the attacks.

On examination, the patient was well-nourished and of a highly nervous disposition. The tendon reflexes were unduly brisk except in the right leg.

Pulse rate was 82 per minute; pulse of good volume. Blood pressure 182/95. There was a trace of albumin in the urine.

The cardiac impulse, which was heaving in character, was in the line of the nipple. The second sound in the aortic area was accentuated.

Fluoroscopy revealed an 'unfolded aortic arch' with moderate hypertrophy of the left ventricle.

He has been on sedatives and theominal tablets for some time now with considerable benefit to the symptoms; his blood pressure keeps at about 170 systolic and 90 diastolic.

**Case 3.**—A Parsee lady, aged 53, a hypertensive for years, had an attack of coronary thrombosis about five years ago; during that attack, there was intense pain behind the middle third of the sternum; the pain lasted for about thirty-six hours; electrocardiograms taken soon after the attack showed coronary occlusion of the Q T type. Since that time she has been subject to typical anginal attacks, usually after exertion; the pain, during these attacks, usually starts behind the middle third of the sternum, radiates to the left shoulder and is relieved by rest and nitrites; it lasts for a couple of minutes or so and is associated with a feeling of tightness in the chest.

For the last few months, the patient has noticed a different kind of pain, limited to the region of the xiphisternum, with a tendency to recur at intervals of a few weeks, especially when she is 'feeling run down' or depressed. It lasts for one to two hours, irrespective of treatment, and is followed by tenderness of the xiphisternum to pressure for as long as twelve hours after the attack; the pain, which has no tendency to radiate in any direction, is not accompanied by any feelings of constriction or choking; depression, crying and other hysterical manifestations occur during the attacks; giddiness, faintness and vasomotor reactions have not been observed. The systolic pressure, which usually keeps at about 170 mm. Hg. in her case, rises to 200 or 210 mm. Hg. during the attacks.

On examination, the cardiac impulse is weak; the apex beat is in the 5th space, 4 inches from the mid-line. The first heart sound is feeble while the second is accentuated, especially at the base. There is an inconstant systolic murmur at the apex.

Crepitations are audible at both lung bases. The liver and spleen are not palpable or tender. There is no œdema of ankles or venous engorgement.

She is at present on deriphyllin (Homburg) and serpina tablets.

**Case 4.**—A Parsee lady, aged 60, has had moderate hypertension for years, the systolic pressure ranging from 160 to 180 and the diastolic from 90 to 100 mm.

Hg. For the last three years, she has had recurrent attacks of subacute cholecystitis with severe pains of a colicky nature. The gall-bladder attacks usually respond to injections of hexamine or cytotropin and anti-spasmodic medicaments. After each attack, the patient remains depressed and anxious for several days afterwards, in constant fear of further attacks. On three distinct occasions, during convalescence after cholecystitis, she has had pain in the lower third of the sternum, lasting for one to two hours; the pain is in the mid-line, has no relation or resemblance to gall-bladder pain and comes on even at rest; it feels 'like a lump' behind the xiphisternum, does not radiate and fails to respond to alkalies, charcoal and anti-spasmodics. During the last attack, the pulse rate was found to be 92 per minute and the blood pressure 196/102. For some hours after the attack, the xiphisternum remains tender to touch.

On examination, she is fat, has a sallow complexion and is usually depressed. The pulse rate usually keeps at 72 to 78 per minute.

The apex beat is in the 5th space, 3½ inches from the mid-line. The heart sounds are normal except for the aortic second, which is slightly accentuated. There is a soft systolic murmur in the pulmonary area. The gall-bladder area is tender to deep palpation.

**Case 5.**—A Hindu male, aged 55, was seen in hospital with a three months' history of breathlessness on exertion, insomnia and cough with expectoration. The symptoms started soon after an 'attack of fever'. For some time he had been subject to attacks of substernal pain. Some of these attacks of pain were of the nature of 'aortalgia', starting behind the upper half of the sternum, radiating to the left shoulder alone or to both shoulders, lasting for fifteen to twenty minutes and accompanied by zones of hyperæsthesia in the left axilla and inter-scapular region at the back.

He also had attacks of pain in the region of the xiphisternum lasting for about two hours, with no tendency to radiation or to cause constriction, and associated with xiphisternal tenderness. During the attacks, he had a feeling of 'something trying to come out of the chest'; he could move about during the pain, though he preferred to 'lie back and rest'.

On examination, he was thin, intelligent and obviously worried about his condition. There was some œdema at the ankles, congestion of the neck-veins was obvious and the liver-edge was palpable and tender. The pulse rate was 85 per minute; blood pressure was 210/140. The apex beat was behind the 6th rib, 4½ inches from the mid-line and heaving in character. There was a systolic murmur in the mitral area, not conducted to the axilla.

The reflexes were brisk; his urine contained albumin.

He improved on rest, reassurance and sedatives. When last seen, his blood pressure was 180/130 and he was free from pain.

**Case 6.**—A married woman, aged 45, was seen in 1937 at Liverpool. She gave a four months' history of breathlessness on exertion, palpitation, attacks of giddiness and excessive fatigue.

She had always been of a nervous disposition, had 'goitre' at the age of puberty and a 'nervous breakdown' in 1927. She came of a neurotic stock.

On examination, she was a well-nourished woman of sallow complexion. She had brisk reflexes and a fine tremor in the fingers of both hands. There was some puffiness around the ankles; the liver and spleen were not palpable.

Pulse rate was 74 per minute; blood pressure was 212/132.

Urine contained albumin but no casts; fundi normal.

Arterial pulsation visible on right side of neck (Rowntree's sign).

The heart was slightly enlarged to the left; a soft systolic murmur was audible all over the præcordium.

She volunteered the information that she had been having attacks of pain 'in the bone above the pit of

the stomach'; it was more of the nature of an ache; it would come on, at intervals of a few days or weeks, usually soon after the midday meal; it would gradually increase in intensity and after lasting for about an hour or so, disappear spontaneously. During one of her attacks, the pulse rate was found to be 78 per minute, and the blood pressure 240/135; the xiphisternum was tender to pressure; a week later, her pressure was 208/130.

*Case 7.*—An English plumber, aged 53, was seen in Liverpool, in 1937, with a year's history of increasing breathlessness, weakness, loss of weight, swelling of both ankles and attacks of pain in the chest.

His father and one uncle had died of 'heart disease'.

He was perfectly fit till 1933, when he had an attack of 'excruciating pain' in the middle of his chest, lasting for a couple of days; it had come on in the middle of the night. He was kept in bed for a couple of weeks after the pain.

Late in 1936, he lost his son during an epidemic of influenza. During the early months of 1937, he had several attacks of pain, of moderate intensity, in the region of the xiphisternum. The pain would usually come on when mounting stairs or climbing uphill, with no tendency to radiate in any direction; during the attacks, he would get 'frightfully worked up' and worry about trivialities, though able to move about; he could get some relief from rest in bed but not from alkalies (soda-mint tablets) or charcoal.

On examination, the neck-veins were engorged and the ankles puffy. The abdomen was fatty; liver and spleen not palpable.

There was moderate enlargement of the heart, the impulse being in the 5th space,  $4\frac{1}{2}$  inches from the mid-line.

The resting pulse rate was 84 and the rhythm regular.

Blood pressure was 176/100. The knee- and ankle-jerks were brisk. The first heart sound was reduplicated and the second loud and ringing in character.

Fluoroscopy showed a moderately enlarged heart, of circular shape. The electrocardiogram showed 'right bundle-branch block'. While his electrocardiogram was being taken he experienced an attack of xiphisternal pain; this was relieved to some extent by a trinitrin tablet; the blood pressure rose to 201/106 during the attack. He was free from pain within twenty minutes or so and walked home.

### *Clinical features*

Clinical features, common to all the cases in this small series, and probably representative of this variety of heart pain, are:—

- (1) Site of pain: Pain is substernal; it is situated low down, usually in the region of the xiphisternum.
- (2) Character of pain: It is usually described by the patient as 'an ache', 'like a lump in the chest' or 'like something trying to come out of the chest'.
- (3) Intensity: The pain is usually 'bearable' or of moderate intensity, seldom attaining the 'incapacitating nature' of true angina pectoris.
- (4) Radiation: Unlike angina pectoris, there is no tendency for this type of pain to radiate in any direction.
- (5) Duration: Duration of attacks is extremely variable, though not in the same patient; they last for anything from five minutes to two hours or more.

(6) Associated phenomena: Emotional outbursts, worrying, depression and crying are frequently observed during the attacks. The patient, instead of being prostrated or immobile, often moves about during the pain. Feelings of constriction and weight, so common in angina pectoris, do not occur. There is no 'angor animi' or 'feeling of impending death'. Vasomotor reactions have not been observed.

(7) Area of tenderness: Pressure on the xiphisternum evokes pain or discomfort during the attack; such xiphisternal tenderness may persist for several hours after each attack.

(8) Exciting causes: Some attacks arise spontaneously, even at rest; the majority of attacks, however, are brought on by worry, depression, emotional outbursts or physical exertion. Worry appears to be the commonest predisposing factor in cases of xiphisternal pain.

(9) Remedial measures: There is no relief obtained from the use of alkaline and carminative draughts; the action of nitrites appears to be slow in these cases. As a rule, the attacks subside spontaneously without any treatment.

### *Definition*

'Xiphisternal ache' or 'low substernal pain' may be defined as an ache or pain in the region of the xiphisternum, of inconstant duration and moderate intensity, with no tendency to radiation, not associated with feelings of constriction or 'impending dissolution', induced as a rule by emotion or exertion and followed in most instances by tenderness at the site of pain.

The sexes appear to be about equally affected. Judging from the cases reported here, the condition appears to favour middle age.

The condition appears to be much more common in private than in hospital practice; it appears to go for the higher strata of society.

### *Differential diagnosis*

*Angina pectoris.*—Xiphisternal ache differs from the angina pectoris of Heberden in several respects: (1) It is limited to the lower third of the sternum or to the region of the xiphisternum. (2) There is complete lack of radiation of pain. (3) The sense of constriction or compression of angina, frequently described as 'vice-like', is absent. (4) There is no 'angor animi' or 'sense of impending dissolution'. (5) Emotional reactions are frequently observed. (6) It results from emotion and mental efforts rather than from physical exertion. (7) It tends to last longer than angina pectoris. (8) It does not cause prostration or immobility of the patient. (9) Response to nitrite therapy is not immediate. (10) Tenderness (to pressure) of the xiphisternum is a common sequel.

*Coronary thrombosis or occlusion.*—Though 'xiphisternal ache' may persist for as long as two hours, it never displays the excruciating pain, dyspnoea, pallor, shock or hypotension of coronary occlusion; the fever, leucocytosis and characteristic alterations in the electrocardiogram of coronary occlusion are also absent.

Attacks of 'xiphisternal ache' do not conform to the clinical picture furnished by Levy and Bruenn (1936) of 'acute coronary insufficiency', a syndrome considered intermediate between angina pectoris and coronary thrombosis.

*Benign cardiac pain.*—The tendency at the present day is towards discarding the word 'pseudo-angina' for more suitable terms like 'angina innocens' (Bourne, 1935) and 'benign cardiac pain' (Bramwell). Excellent descriptions of the benign varieties of heart-pain have recently been furnished by British cardiologists. 'Xiphisternal ache' is distinguished from these forms of pain by (1) the co-existence of cardiac enlargement, usually secondary to high blood pressure, (2) the site of pain, which is substernal and never apical or infra-mammary, and (3) the absence of prostration and vasomotor phenomena.

*Congestion of liver.*—The co-existence of cardiac enlargement in cases of 'xiphisternal ache' may suggest a diagnosis of hepatalgia due to acute passive engorgement of the liver; in the latter case, however, pain and tenderness are not limited to the region of the xiphisternum, but involve the right upper quadrant of the abdomen and back; also the liver is enlarged and palpable in such cases; pain due to liver engorgement is usually protracted and responds to cardiac remedies and decongestives.

*Gastric flatulence.*—Unlike 'xiphisternal ache', pain occasioned by the accumulation of gas in the stomach is usually situated below the level of the xiphisternum, is more diffuse in character, has a tendency to shift, tends to last longer, has no relation to exercise, is associated with belching or eructations and responds to alkaline and carminative medicaments.

*Xiphisternal tenderness.*—No confusion should arise between the condition described here as 'xiphisternal ache' and the quite distinct condition of 'xiphisternal tenderness', the latter appears as a physical sign in conditions, as widely separated and distinct as disorders of the blood (leukæmias), hepatitis, liver congestion, gastritis and local diseases of bone. It may be noted, however, that attacks of 'xiphisternal ache' may be followed by tenderness of the xiphisternum to pressure, for a variable period of time.

### Discussion and conclusions

Certain features about 'xiphisternal ache' justify its inclusion into the category of anxiety state or neurosis. The mental make-up of the affected individuals is characteristic; they are all 'hypersensitive', have brisk reflexes, are unduly sensitive to Libman's pain test (Libman,

1934) (i.e., pain on pressure over the styloid process of the temporal bone), are liable to emotional outbursts and are constantly worrying and anxious about their condition. In case 4, attacks of 'xiphisternal ache' were precipitated by the fear of biliary colic; in case 2, attacks became particularly frequent when the patient began to suspect 'a tumour in the brain'; in case 7, the first attack of pain occurred soon after the death of the patient's son.

The importance of psychological factors and mental influences in angina pectoris has been stressed of late by Bourne (1937), Bourne *et al.* (1937), Roberts (1931) and others. There is no doubt that the sensitivity of the nervous system has a big part to play in determining the character of the anginal attack. In 'hyposensitive individuals', for example, angina is said to take unusual or bizarre forms (Libman, 1934; White, 1937). Would it not be possible, therefore, for the opposite condition of a 'hypersensitive nervous system', such as exists in the group of cases reported here, to modify or alter the character of an anginal attack? Also, would it not be possible for such a state to render subminimal or weak stimuli, which are normally incapable of arousing heart-pain, more liable to attain the thresholds of pain and thereby facilitate the production of anginal pain?

Besides a hypersensitive nervous system, other factors appear to be concerned in the causation of 'xiphisternal ache'. High blood pressure appears to be a constant feature of such cases; the seven cases reported here are all subjects of hypertension; while in four of the cases there is a superadded history of coronary occlusion in the past, the others reveal nothing suggestive of a coronary ætiology. Hypertension cannot be held solely responsible for 'xiphisternal ache', in view of the fact that the great majority of cases of high blood pressure do not at any time experience this form of pain. The frequent association of cardiac neurosis with organic heart disease is too well known to need reiteration.

Records of blood pressure taken during and between attacks of pain have invariably shown transitory rises of systolic pressure, of about 20 to 40 mm. Hg., during the attacks; such rises of pressure are usually associated with subjective feelings of discomfort, occipital headache, throbbing in the neck and chest and vertigo.

The above facts suggest the likelihood of several factors being concerned in the pathogenesis of 'xiphisternal ache', viz, (1) a hypersensitive nervous system or psychological factors, (2) organic heart disease, usually secondary to high blood pressure, (3) transitory rises of systolic blood pressure (? hypertensive crises). Whether all these factors are actually concerned in bringing about 'low substernal pain', is difficult to say in the present state of our knowledge, which can only be described as fragmentary.

If it is not too presumptuous on my part to conjecture an opinion, I may make the

tentative suggestion that the type of pain described here as 'xiphisternal ache' be regarded as a *forme fruste* or anomalous form of angina pectoris. In spite of the many points of dissimilarity, clinically demonstrable, between true angina and 'xiphisternal ache', the anginal character of the latter is suggested by the co-existence of organic heart disease and by the hypertensive crisis which occurs during the attacks. Clinical differences between the two types of pain (angina pectoris and 'xiphisternal ache') are perhaps due to the hypersensitive state of the nervous system in the latter.

A perusal of the literature reveals frequent references to mild and atypical forms of angina pectoris, some of which display striking similarity to the type of pain described here as 'xiphisternal ache'. Thus, Osler (1916) refers to the so-called 'mildest form' of angina as 'a feeling of substernal tension, uneasiness, or distress, rising at times to positive pain, usually associated with emotion, but soon passing off' and 'without accurate localization or radiation'. In his short treatise on medicine, Basu (1929) stresses the importance of distinguishing true angina from 'the substernal sensation of light oppression felt by some people with high blood pressure, on hastening to catch a train or bus'. In his opinion, such mild forms of pain (so-called angina mitis of Allbutt) are not at all uncommon in India.

#### Summary

(1) Attention is drawn to an atypical form of heart-pain; the designation 'xiphisternal ache' (or alternatively 'low substernal pain') is suggested for it, as being the most suitable.

(2) Seven cases of hypertensive disease of the heart exhibiting this form of pain are described.

(3) The clinical characteristics are enumerated and the differential diagnosis discussed.

(4) Factors which are possibly concerned in the genesis of 'xiphisternal ache' are considered. The condition is regarded as a *forme fruste* or anomalous form of angina pectoris liable to arise in individuals of a 'hypersensitive type'.

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## A REPORT ON THE USE OF CADMIUM SULPHIDE IN THE TREATMENT OF PULMONARY TUBERCULOSIS AT THE JADABPUR TUBERCULOSIS HOSPITAL

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For the last few years, gold salts have been used extensively for the treatment of pulmonary tuberculosis, but their high price has placed them well beyond the means of the average patient. It is a common experience to find poor patients exhausting their resources on a few tentative doses of gold preparation, much too small to produce any tangible result, and then giving up treatment in despair. Our attention was drawn to the possibility of using cadmium in place of gold by an article of Heaf in the *British Journal of Tuberculosis* (1937). Cadmium being a cheaper metal would certainly bring relief to the poor patient of this country, if in action it were anywhere near the gold preparations. If this was true in 1937, it is far more so in 1941, when, due to war conditions, not only has the price of gold salts gone up, but the question of their availability is becoming increasingly serious. We are relating our experience with cadmium after having tried it in 100 cases, and we feel sure it would be of interest to those who have to deal with large numbers of tuberculosis patients.

Our work is spread over a period of about three years extending from October 1937 to September 1940. One hundred cases of pulmonary tuberculosis were treated with injections of cadmium sulphide during this period. Of these, 20 cases having received less than ten injections are excluded from this report. Forty-six of the remaining 80 cases were treated with cadmium sulphide alone and the rest received cadmium sulphide in combination with phrenic evulsion or artificial pneumothorax.

As early as 1913, Lumiere and Chevroitier tested the inhibiting influence of various metallic salts on the growth of tubercle bacilli. They found that chlorides of cadmium and mercury retarded its growth even in a dilution of 1:4,000.

Lund treated 38 cases of pulmonary tuberculosis with cadmium diuretin. He claims that 24 of these cases lost tubercle bacilli from their sputum. There were some pleural reactions simulating dry pleurisy.

Walbum (Wells and Long, 1932) assessed the value of 42 different metals in the treatment of tuberculosis produced in rabbits. His report is that only cadmium and manganese when given in minute doses produce some curative effect.

Heaf (1937) treated a series of cases of pulmonary tuberculosis with sulphide or glycine of cadmium. His opinion is that the compounds are absolutely harmless and the beneficial results obtained by their use are quite worthy of comparison with results of gold therapy.

Robertson (1939) treated 16 cases on the same lines as Heaf with sulphide of cadmium. He reports that radiologically there was no improvement in any of these cases except one who had doubtful lesion at the apex, but he made no mention of the clinical aspect of these cases.

However, the promising reports of all these workers except Robertson justify an earnest attempt to assess the proper value of cadmium sulphide in the treatment of pulmonary tuberculosis.

#### *Selection of cases*

Our cases were selected at random and not according to any definite plan. At first, only rather advanced cases were available for this new treatment. Later on, as some of these cases improved clinically without showing evidence of any reaction, a few cases with brighter prospects agreed to be treated with this new metal instead of gold. According to the anatomical extent of the lesions the cases might be classified as follows :—

Group I.	Cases with small apical lesion without breakdown in one or both lungs ..	5 cases
Group II.	Cases without breakdown whose total lung area affected does not exceed that of a lobe ..	6 "
Group III.	Cases with not less than two lung lobes affected without breakdown and all cases with breakdown ..	69 "

TOTAL .. 80 cases

#### *Pharmacology and dose*

Very little is known about the pharmacology of this metal. The few animal experiments that are on record show that in poisoning doses it produces loss of appetite, vomiting and albuminuria. It is probably excreted through the kidneys and salivary glands. All previous workers are absolutely silent about its mode of action in tuberculosis.

We followed strictly the technique of Walbum who stressed the efficacy of very small doses. A one-per-cent emulsion of cadmium sulphide in sterile olive oil containing 0.25 per cent of phenol was used for injection. The usual dose was 1 c.cm. given intramuscularly once a week. In some of the afebrile cases with good general condition the same dose was given twice a week. The average number of injections given per patient was 31.8, which corresponds to 0.318 gramme of the sulphide. The maximum number of injections given to a patient was 161, equivalent to 1.61 grammes of the sulphide.

We are greatly indebted to Dr. K. L. Shaha of Oriental Chemical Works, Ltd., for preparing the emulsion for us and supplying it in 1 c.cm. ampoules. He used freshly precipitated and

dried cadmium sulphide to prepare the emulsion. It is now available in the market under the trade name of theocardium 'A' oleosum.

#### *Preliminaries and contra-indications*

The urine of the patient was carefully examined for presence of any albumin and sugar before starting a course of these injections as well as after each subsequent injection of cadmium. The following symptoms were considered to be contra-indications for starting these injections. If any of these symptoms did appear during a course, the injections were temporarily withheld and restarted after at least a couple of weeks from the subsidence of these symptoms.

(a) Presence of albumin or sugar in the urine.

(b) Persistent presence of a temperature above 101°F.

(c) Presence of diarrhoea, colitis or vomiting.

(d) Presence of hæmoptysis even in the mildest form.

#### *Reactions and complications*

Practically no definite reaction was observed in most of these cases throughout their course of injections. A few cases did have occasional coloured sputum for which, knowing the advanced condition of the patients, it will be an injustice to blame the injections. Some of the cases treated were under observation for more than a year, yet they did not show evidence of any cumulative action of the metal.

#### *Results of treatment*

It is very difficult to estimate the proper value of any special treatment when we know that fresh air, good food, rest and graduated exercise are playing their parts as well. It becomes still more misleading when combined with some form of surgical treatment. The only way to neutralize these factors is to compare results with some recognized methods of treatment carried under similar conditions. In the subsequent tables results obtained with cadmium therapy alone is compared with those obtained with cadmium *plus* collapse therapy. The average of these two results is again compared with similar averages of solganal 'B' (Ray *et al.*, 1933) and sanocrysin treatment (Ray *et al.*, 1932) reported from this hospital.

A. Effect on physical signs (tables I and II).

One word of explanation is necessary about table I. Of the 11 early cases in the whole series, 10 were treated with cadmium alone and one case with cadmium and collapse, which fact has somewhat vitiated the figures. If these early cases are excluded the percentages of cases benefited are—

with cadmium alone 30.5 per cent instead of 45.6 per cent,

with cadmium and collapse 42.4 per cent instead of 44.0 per cent,

which correctly represents the true state of affairs.



TABLE I  
*Effect on physical signs*

Treatment received	Total cases	Totally arrested	Considerably improved	No improvement
Cadmium alone .. ..	46	7 or 15.2%	14 or 30.4%	25 or 54.4%
Cadmium and collapse .. ..	34	6 or 17.6%	9 or 26.4%	19 or 56.0%
TOTAL ..	80	13 or 16.2%	23 or 28.7%	44 or 55.1%

TABLE II  
*Effect on physical signs*

Average of	Total cases	Totally arrested	Considerably improved	No improvement
Cadmium treatment .. ..	80	13 or 16.2%	23 or 28.7%	44 or 55.1%
Solganal 'B' treatment .. ..	42	8 or 19.0%	12 or 28.5%	22 or 52.5%
Sanocrysin treatment .. ..	32	6 or 18.7%	9 or 28.1%	17 or 53.2%

## B. Effect on tubercle bacilli in the sputum.

TABLE III

Particulars of treatment	Cases with tubercle bacilli in sputum	Rendered tubercle bacilli negative
Cadmium alone ..	30	8 or 26.6%
Cadmium and collapse ..	29	14 or 48.3%
Average of cadmium ..	59	22 or 37.3%
Average of solganal ..	36	12 or 33.3%
Average of sanocrysin ..	32	13 or 40.6%

## C. Effect on fever.

TABLE IV

Particulars of treatment	Febrile cases	Rendered afebrile
Cadmium alone ..	33	8 or 24.2%
Cadmium and collapse ..	27	14 or 51.8%
Average of cadmium ..	60	22 or 36.6%
Average of solganal ..	36	10 or 27.7%
Average of sanocrysin ..	28	9 or 32.1%

## D. Effect on skiagram.

It is impossible to give a comprehensive idea of the changes from the very limited number of skiagrams at our disposal. During the earlier part of the treatment the lesions tend to become more dense and harder. These densities are very slowly replaced by fibrous deposits, taking several months over the process. There was no complete clearing of the lesions in any of the cases.

From the tables it will be evident that the result of treatment of combined cadmium and collapse therapy is somewhat superior to that of cadmium therapy alone. When comparing the average results of cadmium, solganal and sanocrysin, similarity of the figures is very striking.

This fact will lead one to believe that if there is any curative effect of solganal and sanocrysin in pulmonary tuberculosis, it must be possessed and to an equal extent by cadmium sulphide as well.

*Advantages and disadvantages*

The points in favour of cadmium therapy are that it is very cheap and, being an insoluble compound, its absorption can never be sufficiently rapid to produce any toxic symptom. The only drawback is the enormous time required to inject a quantity of the compound sufficient for producing curative changes in the lesions. This may, however, be got over by increasing the amount and increasing the percentage of cadmium from 1 to 2 per cent without much difficulty.

*Conclusions*

From the foregoing paragraphs we are justified in drawing the following conclusions:—

- (1) When used alone, cadmium gives almost equally good results like those of solganal and sanocrysin in the treatment of pulmonary tuberculosis.
- (2) It is a valuable adjunct to collapse therapy.
- (3) Its cheapness is an additional advantage.
- (4) The course of treatment is very long. This may be shortened by increasing the dosage.

Our thanks are due to all colleagues in the hospital for collaboration and assistance.

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## REDUCTION OF BENEDICT'S SOLUTION BY URINE DURING A COURSE OF SULPHATHIAZOLE THERAPY

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SULPHATHIAZOLE is a new member of the sulphonamide group which promises soon to be available to the general medical profession; therefore, the occurrence of a substance in the urine which reduced Benedict's solution is of interest, as to date no mention of this reaction has appeared in the literature on the subject which is available. The following is a history of a patient with *Staphylococcus aureus* and *Streptococcus hæmolyticus* septicæmia in whom copper was constantly reduced during sulphathiazole therapy although the blood sugar was 73 mg.

M. R. R., a seven-year-old boy, was admitted into the Miraj Medical Centre on 12th September, 1940, complaining of severe pain in the right hip of eight days' duration. While being chased by a dog, he fell heavily on the right hip. The dog bit him superficially, but the boy arose and was able to walk without difficulty for 24 hours. He then began to complain of pain in the right hip and to limp. Fever, swelling of the hip and chills followed in rapid succession. Distension of the abdomen and red urine was noted three days after onset. A local doctor was consulted, compresses applied to the hip and medicine given to reduce fever. After two days of such treatment, hospital admission was sought. The patient was said to have had malaria three months previously.

The temperature on admission—101.6; pulse—128; respiration—26; blood pressure—115/75. The patient was thin, toxic appearing with dry skin, and an infected abrasion of the scalp 2 inches in diameter was present. Moderate distension of the abdomen was present. A hot tense swelling involving the upper thigh and right hip joint extended anterior to the iliac crest. No definite fluctuation could be made out. The leg was markedly abducted and flexed on the thigh. All motion was painful but, with care, passive motion was not limited. The superficial dog bites had healed without scarring or infection.

It was felt the boy had acute osteomyelitis involving the right hip and pelvis associated with abscess formation. Immediate x-ray examination did not disclose any abnormality of hip or pelvis. In the laboratory, the white blood count was 16,000 with 75 per cent polymorphonuclears; 24 per cent lymphocytes; 1 per cent monocytes. Hæmoglobin was 70 per cent (Salhi). The patient could not void on admission and catheterization was not done. 500 c.cm. of 5 per cent glucose was given intravenously immediately: the urine, collected after this was given, was dark yellow, acid, specific gravity 1005, albumin present, 0.2 per cent sugar, leucocytes present in a fair number, but no red blood cells or casts. Fluids were given freely, the urine became negative for sugar; the following day under general anaesthesia an incision was made over and slightly above the greater trochanter; the muscles split and about four ounces of thick yellow pus evacuated, the last portion of the pus being watery. Smears were positive for staphylococcus and streptococcus. The joint was not opened. Drainage was provided.

Post-operatively, the temperature fell to normal, but reached a peak of 102° on the third day. Smears for malaria were negative, but quinine sulphate, 20 grains daily, was started. Blood culture taken on the sixth day after operation was reported positive for staphylococcus and streptococcus. Sulphanilamide, 4 grammes daily, was given for eight days without relief at which time the colony count was 8 per c.cm., 7 *Staphylococcus*

*aureus* and 1 *Streptococcus hæmolyticus*. The hæmoglobin fell to 45 per cent (Salhi), and the white blood cells to 3,400; 30 per cent of these were 'stab' or young forms; 35 per cent were segmented polymorphonuclears. The urine consistently contained albumin and white blood cells with no red blood cells or casts, and no further sugar was noted after the first specimen collected shortly after intravenous glucose was given.

After the 15th blood matching, the boy's mother was requested to appear and did so after some delay on the 13th day after operation; her blood was matched and 300 c.cm. of blood was given. Swelling was noted the day prior to transfusion in the perineal region and incised, with the liberation of a small amount of thin watery pus. The temperature was lower for three days.

Sulphathiazole was secured and started immediately after discontinuing sulphanilamide; 2 grammes given as the initial dose followed by 1 gramme every four hours for the next seven days. The morning after sulphathiazole, the urine contained 1 per cent sugar although no glucose had been given for three days. During sulphathiazole, the urine consistently contained from 0.5 per cent to 1.0 per cent sugar with the fasting blood sugar of 73 mg. No glucose was administered until a day after sulphathiazole was stopped, when the urine, for the first time since starting sulphathiazole, was negative for sugar. It remained negative for sugar until discharge.

A blood culture, taken on the last day of sulphathiazole therapy, was negative as was another taken eight days later. Seven days of sulphathiazole therapy had sterilized the blood stream which remained sterile. The pus from the wound showed marked diminution in the number of organisms—so much so that this was noted spontaneously by the laboratory examiner. An x-ray film taken at this time showed marked and widespread destruction of the right ileum extending into the acetabulum. On the first day of sulphathiazole therapy, a metastatic abscess had appeared over the left humerus, but healed promptly with incision. The smear showed many staphylococcus and streptococcus. Although laboratory improvement was marked, the temperature continued to reach 102° daily. The patient did not appear so toxic and seemed much better for four or five days. Then, swelling of the feet and eyes developed; the serum proteins were 5 mg.; blood urea was 40 mg.; blood plasma from the 'blood bank' was given; at this time I became sick and during my absence, discharge was requested and granted without my knowledge. Red blood cells had appeared in the urine, for the first time in the hospital, 12 days after sulphathiazole was stopped. Albumin was also increased in quantity; no casts were observed.

This case presents several points of interest. The first of these is the fact that sulphathiazole effected sterilization of the blood stream where sulphanilamide had failed to do so. One would have anticipated that sulphanilamide probably would not affect the staphylococcus, but one would anticipate the streptococcus would be cleared. Sulphathiazole, in this instance, exerted a more powerful effect against the streptococcus than sulphanilamide had appeared able to do.

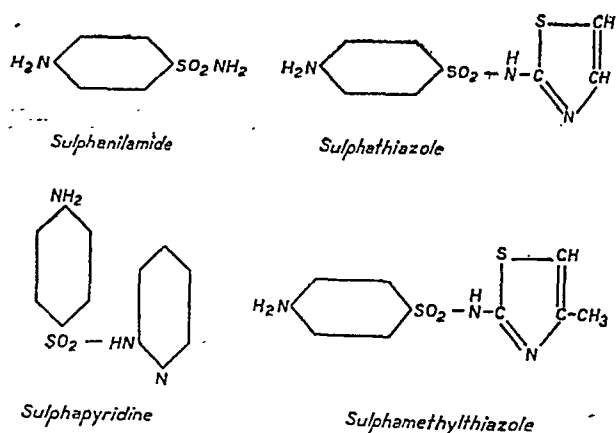
In the second instance, sulphathiazole effected sterilization against staphylococcus where all other measures had failed.

In the third instance, sulphathiazole seemed to either lower the kidney threshold for sugar in this instance, as a copper-reducing substance was consistently present in the urine with a blood sugar of 73 mg., or some copper-reducing substance was excreted by the kidneys when sulphathiazole was administered as this disappeared promptly with the stoppage of the drug and did not re-appear. This effect was not

observed with sulphanilamide. It is regrettable a sugar tolerance test was not done prior to the discharge so that a more accurate idea of the mechanism involved might have been obtained.

In the fourth instance, sulphathiazole either did not prevent the formation of a hæmorrhagic nephritis or had no effect of a beneficial nature upon nephritis which was probably present on admission. Neither did it appear to aggravate any condition that may have been present as its action on the kidney is thought to be purely mechanical, as far as causing hæmaturia is concerned, and red blood cells first appeared in the urine 12 days after stoppage of the drug which is rapidly eliminated.

The various properties of sulphathiazole are fast becoming a matter of increasing importance, and now that the drug is available for general distribution, a knowledge of its place in the group of sulphonamides is essential. A few well-founded facts can be enumerated from the available literature. The following structural formulæ show the relationship between the four drugs of this group:—



A major part of the facts now known about this new drug are listed below:—

Sulphathiazole's acute toxicity is definitely less than sulphapyridine or sulphamethylthiazole (Long, 1940).

Sulphathiazole is more readily absorbed from the gastro-intestinal tract than is sulphapyridine and is more rapidly excreted (Long, *loc. cit.*).

Much larger amounts of sulphathiazole are excreted in the urine; after injection it can be recovered quantitatively. It has been found very efficacious against infections of the urinary tract caused by *Staphylococcus aureus* and *Streptococcus faecalis* where sulphanilamide is valueless. It will not overcome infections secondary to some definite pathological obstruction, however, as this is too much to expect of any drug (Pool and Cook, 1940).

Against gonorrhœal urethritis, sulphathiazole has demonstrated a rapid beneficial effect (Stirling, 1940; Lloyd and Erskine, 1940).

In furunculosis, sulphamethylthiazole has proved of definite beneficial value (Grulee and Mason, 1940).

Experimentally, in pneumococci, meningococci, hæmolytic streptococci, lymphogranuloma venereum, and plague, sulphathiazole has been found to be of beneficial value. Clinically, relapses in pneumonia have been more frequent with sulphathiazole than with sulphapyridine. This is explained on the basis of more rapid excretion (McKee *et al.*, 1939).

**Reactions:** These are fairly common with sulphathiazole, but do not have the severity of the other drugs of the group.

**Skin.** Rashes of three types have been noted—a maculo-papular, urticarial and erythema nodosum. Rashes developed in 13 per cent of 76 cases (Haviland and Long, 1940).

**Eye.** Conjunctival and scleral injection restricted to the bulbar conjunctiva and scleræ occurred in 9 per cent of 76 cases (Haviland and Long, *loc. cit.*).

**Gastro-intestinal.** Nausea occurred in 20 per cent of cases (Pool and Cook, *loc. cit.*) but was not associated with vomiting. No acidosis is produced by sulphathiazole, so administration of soda is not necessary.

**Genito-urinary.** Hæmaturia associated with dumb-bell, rosette and chestnut-burr-shaped crystals in the urine has been reported repeatedly (Long, *loc. cit.*; Arnett, 1940). Catheterization of the ureters and lavage with warm water may be necessary in cases of urinary suppression.

At the present time there is no evidence to believe that any kidney damage, other than mechanical, is exerted by the drug.

**'Drug fever'.** Drug fever associated with marked vertigo, headache, nausea and palpitation is reported (Pool and Cook, *loc. cit.*).

**Hæmopoietic system.** Sulphathiazole is said to contain the same inherent tendency of sulphonamide groups to depress the hæmopoietic system and daily red blood cell counts and white cell counts are indicated. In this case, although the leucocytes were only 3,400 at the start of sulphathiazole and large doses were given to a small boy, no depression of the leucocytes was noted.

**Dosage.** Two initial doses of 2 to 3 grammes each have been recommended followed by 1 gramme every 4 hours for an average-sized adult. This dosage has proved adequate in staphylococcus septicæmia, urinary tract infections caused by *Staphylococcus aureus*, *Streptococcus faecalis*, or gonorrhœa, but has been followed by relapses in pneumococci infections. The drug usually exerts a beneficial influence early—within 48 hours or not at all. Reactions usually occur after 4 to 5 days' administration, although they may occur after the initial dose of the drug (Pool and Cook, *loc. cit.*).

**Summary.**—A case of staphylococcus and streptococcus septicæmia is presented in which a copper-reducing substance was excreted by the kidney constantly during sulphathiazole therapy, although the blood sugar was 73 mg. This cleared promptly with stoppage of the drug.

(Continued at foot of opposite page)

## URINARY EXCRETION OF NICOTINIC ACID IN PELLAGRINS

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and

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WHEN the identification of pellagra-preventive factor with nicotinic acid, and the therapeutic value of nicotinic acid and its amide in the treatment of pellagra became established, it was desirable to devise methods for their quantitative determination in urine, in order to provide useful information in clinical investigations and for assessing the level of nutrition with respect to nicotinic acid, similar to those already in use for vitamin C and vitamin B<sub>1</sub>.

Various methods have been suggested for the quantitative determination of nicotinic acid. All these methods are based on the reaction in which the pyridine nucleus of the nicotinic acid is broken down by cyanogen bromide and an aromatic amine to give a compound which is coloured yellow. The intensity of the colour, which is a measure of the nicotinic acid content, is determined colorimetrically. Various amine reagents have been suggested for the development of the colour and it is found that p-aminoacetophenone, which has been recently introduced by Harris and Raymond (1939), possesses many advantages over the reagents (aniline, metol, etc.), suggested by other workers (aniline

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This must be a rather rare reaction for the drug and confined to a group of susceptible persons as no reports of similar cases have been published in the wide use of closely related drugs.

I wish to acknowledge the kind and instantaneous co-operation of Lieut.-Colonel S. S. Sokhey, Director, Haffkine Institute, Bombay, who furnished the sulphathiazole used.

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by Swaminathan, 1938; Kringstad and Naess, 1939; Pearson, 1939; Ritsert, 1939; metol by Bandier and Hald, 1939; naphthylamine by Euler *et al.*, 1938). The intensity of the colour produced with this reagent is very high and it is 3 to 5 times as sensitive as aniline and metol. The colour is quite stable and the reaction is found to be very specific for nicotinic acid. By employing this reagent Harris and Raymond (*loc. cit.*) worked out a method for the determination of nicotinic acid content in urine. The Pulfrich photometer was used for the estimation, and the nicotinic acid content was calculated by extrapolation of the line drawn from the photometric readings. As the photometer is not easily available in ordinary biochemical laboratories, we have modified the photometric part to adapt the method to ordinary colorimetry. The principle of the method is, however, the same as that described by Harris and Raymond. As long as the urine is coloured yellow to brown after hydrolysis with sodium hydroxide, this method works well. In those cases where the urine exhibits an intense red colour after hydrolysis, which is very rare, it is rather difficult to obtain accurate values.

We describe below the principle involved in the method and its application to the determination of the urinary excretion of nicotinic acid in normal persons and pellagrins. The response to test doses, which indicate the degree of 'saturation' of pellagrins with respect to nicotinic acid, has also been investigated.

### Method

The reagents, CNBr solution (saturated bromine water decolorized by 10 per cent KCN) and p-aminoacetophenone (1 gr. dissolved in 2.8 c.cm. 10 per cent HCl and made up to 10 c.cm. with water) were prepared as described by Harris and Raymond.

Twenty-five c.cm. of the urine were measured out into a conical flask, 5 c.cm. of 20 per cent sodium hydroxide solution were added and kept in boiling water-bath for about 30 minutes, in order to convert the nicotinamide into nicotinic acid. The solution was then neutralized with concentrated HCl after the addition of 2 c.cm. of 4 per cent NaHCO<sub>3</sub> to stabilize the end-point. The solution was finally adjusted to pH 6.0 (bromothymol blue as indicator) by the addition of dilute HCl or NaOH as the case may be, and diluted to 50 c.cm.

Four graduated glass-stoppered cylinders (20 c.cm. capacity) are taken, the first one serves as blank, the second one, the unknown and the third and fourth are controls to which known amounts of nicotinic acid are added. These cylinders will be designated as x, A, B and C, respectively. To B and C are added 0.2 c.cm. and 0.4 c.cm. of standard nicotinic acid solution (1 c.cm. = 100  $\gamma$ ) respectively. Ten c.cm. of the dilute urine solution are pipetted into each of the four cylinders and kept in the hot water-bath at 80°C. for about 10 minutes. Then 2 c.cm. of CNBr reagent is added only to the last three, i.e., A, B and C, but not to x (to which 2 c.cm. of water is added instead), shaken well, and after 4 minutes the cylinders are kept in cold water. After 4 minutes' cooling

0.2 c.cm. of the amine reagent is added to all the four cylinders and after mixing well, they are kept in a dark place, covered with black paper in order to avoid exposure to light. After 15 minutes 0.4 c.cm. of 10 per cent HCl solution is added, and the colours compared in a colorimeter after 15 minutes keeping in a dark place.

*Calculation.*—Harris and Raymond calculated the nicotinic acid content of the experimental solution by drawing a graph, taking the photometric readings as measured with the Pulfrich photometer with S 47 filter, as ordinates and the corresponding known amounts of nicotinic acid added as abscissæ. The straight line which is thus obtained is produced backwards to cut the axis and the distance between the origin and the point at which it cuts the axis represents the amount of nicotinic acid in the solution.

The principle of this method has been applied by using the ordinary colorimeter to measure the intensity of the colour. The method we have adopted is fully described below.

The blank solution x is taken as standard, against which the intensity of the colours of the other three samples was determined. The ratios, 20/R (where R is the colorimetric reading obtained for A, B and C, when the reading for x is 20), between the intensities of the colours of x on the one hand and A, B and C on the other were determined, and is subtracted from each of the values thus obtained. A graph is constructed taking these values as ordinates and

the total amount of nicotinic acid can be easily calculated.

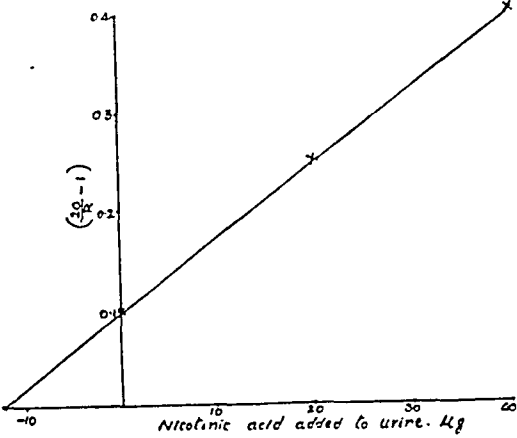


Fig. 1.—Graph showing the relation between the colorimetric values and the corresponding known amounts of nicotinic acid added to the urine. Nicotinic acid content = 12.5 mg.

*Urinary excretion of nicotinic acid in normal adults.*—The method described above was applied to the determination of the amount of nicotinic acid excreted in 24-hour urine by normal persons consuming an adequate diet and we found the figures to vary from 4.8 to 6.1 mg. In the following table are given the range of values obtained for the urinary excretion of nicotinic acid in normal adults as determined by various workers in different laboratories.

TABLE I

	x blank used as standard and kept at 20 mm. representing the colour of the urine	COLORIMETRIC READINGS		(20/R—1)
		R	Ratio between the standard and the experimental solution (20/R)	
A. Unknown .. .. .	20	18.3	1.1	0.1
B. Unknown + 20 γ nicotinic acid .. ..	20	16.0	1.25	0.25
C. Unknown + 40 γ nicotinic acid .. ..	20	14.4	1.4	0.4

the corresponding amounts of nicotinic acid added (0, 20, and 40 γ, respectively) as abscissæ. The line so obtained by joining the points is produced backwards till it meets the abscissæ somewhere at a point away from the origin. The distance between the origin and the point at which the line meets the abscissæ is a measure of the nicotinic acid content of the urine. To make it more clear the principle of the method is illustrated by the following example :—

In figure 1 the values (20/R—1) are plotted against the amounts of nicotinic acid (0, 20 and 40 γ) added to the urine. On producing the line backwards it cuts the abscissæ at a point which corresponds to 12.5 γ nicotinic acid present in 10 c.cm. of the urine solution. From this value

TABLE II  
*Urinary excretion of nicotinic acid in normal adults*

Author	Place	Nicotinic acid excreted in 24 hours, mg.
Harris and Raymond (1939).	Cambridge	3.0 to 5.0
Rosenblum and Jolliffe (1940).	New York	3.4 to 10.2
Swaminathan (1939)	India (Coonoor)	3.15 to 6.77
Present authors ..	India (Vizagapatam)	4.8 to 6.1

From the above table it is clear that irrespective of nationality the daily excretion of nicotinic acid by normal adults may be taken to lie between 3.0 to 10 mg., the lowest value being 3.0 mg. If the nicotinic acid content of urine is below 3.0 mg. the person may be considered to be deficient in this vitamin.

*Urinary excretion of nicotinic acid in pellagrins.*—We studied the excretion of nicotinic acid in three pellagrins of whom two happened to be wife and husband. The wife showed more advanced pellagrous symptoms than the husband. We studied this case in detail and investigated the response to test doses of nicotinic acid. In the following table are shown the nicotinic acid content of the urine of the three pellagrins as soon as they were admitted to the hospital.

TABLE III

*Urinary excretion of nicotinic acid in pellagrins*

Sex	Age	Nicotinic acid excreted in 24-hour urine, mg.
1 Female ..	18	0.0
2 Male ..	32 (husband of patient no. 1).	0.0
3 Male ..	20	1.8

The results show that a negligible amount of nicotinic acid is excreted in the urine of the pellagrins.

Next we investigated the response to test doses of nicotinic acid in one case. This pellagrin is a female aged about 18 years. When admitted to the hospital she presented typical pellagrous symptoms with dermatitis on the dorsum of both the hands and two small patches of skin lesions on the lateral part of the arm. Gastric analysis showed that she suffered from achylia.

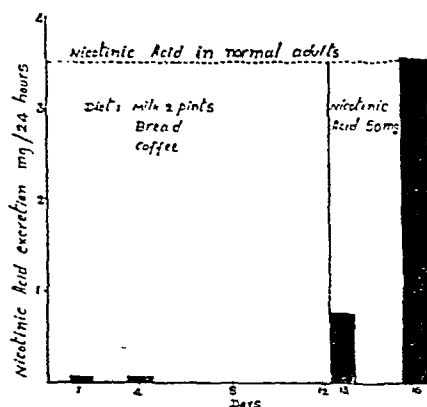


Fig. 2.—Excretion of nicotinic acid in a pellagrin.

The variation in the levels of nicotinic acid excretion of the patient with diet and treatment

with nicotinic acid is shown in figure 2. It can be seen from the figure that the nicotinic acid content of the urine, when the patient was admitted to the hospital, was practically nil, and later increased slightly on hospital diet consisting of bread and milk. The excretion of nicotinic acid attained the normal value only after the administration of nicotinic acid (50 mg. daily). As soon as the normal value had been reached, the external symptom, dermatitis, completely disappeared. Thus, it would appear that the determination of the nicotinic acid content of urine may afford a useful guide in the treatment and clinical investigations of pellagrins. It affords a valuable and probably an earlier diagnosis of pellagra.

### Summary

Harris and Raymond's method for the estimation of nicotinic acid content of urine has been modified to adapt the method to ordinary colorimetry. The method was applied to the determination of the urinary excretion of nicotinic acid plus nicotinamide expressed as nicotinic acid. The nicotinic acid content of the urine of typical pellagrins was found to be negligible; it increases somewhat when the patient is put on hospital diet consisting of milk and bread. Administration of 50 mg. of nicotinic acid daily (intramuscularly) raised the nicotinic acid content of urine to normal value, when all the typical symptoms of pellagra disappeared.

### Acknowledgments

The authors wish to acknowledge with thanks facilities granted by Major J. F. Shepherd, principal, and Professor V. K. Narayanamenon for carrying out the above investigations in the biochemical laboratories of the Andhra Medical College, Vizagapatam. The authors also wish to acknowledge valuable assistance received from Dr. C. K. Prasadha Rao in supplying material and other useful information regarding the treatment of the cases reported in this paper, and also to Dr. K. N. Pisharotti, second physician, and to the superintendent of the hospital.

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# THE USE OF CASSIA FISTULA IN THE TREATMENT OF BLACK-WATER FEVER\*

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and

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BLACK-WATER fever is an acute febrile disease of unknown causation, characterized by rapidity of the destruction of the red blood cells and the subsequent onset of hæmoglobinuria and jaundice.

This disease occurs extensively in tropical Africa and in certain regions of India. It has been reported to occur also in many other parts of the tropics. In the Madras Presidency, it is endemic in the Agency Tracts of Ganjam, Vizagapatam, and East Godavari districts, and occurs sporadically in the Kollegal taluk of the Coimbatore district, Gudalur taluk of the Nilgiris district, and the Wynaad taluk of the Malabar district. In these areas it has been known to occur mostly during the winter months, the onset being sudden, the course rapid, and the mortality high.

The ætiology of the fever is still uncertain and no specific remedy is yet available for the treatment of the disease. However, it is claimed in some of the affected areas that the liquid extract of *Cassia beareana* gives satisfactory results in relieving the symptoms of this disease. This extract is prepared from the root-bark of *Cassia beareana*, a tree native to tropical East Africa. The tree owes its present name to its discoverer O'Sullivan Beare, an English doctor. This species does not grow either in India or Ceylon. An investigation was therefore undertaken to find out if any of the indigenous species of the cassia family could be utilized as a substitute for *Cassia beareana* in the preparation of a therapeutically active extract. In the course of the investigation an extract prepared from the root-bark of *Cassia fistula* was found to give encouraging results.

*Cassia fistula*, belonging to the natural order Leguminosæ, is a native of tropical Asia and grows abundantly all over India and Ceylon up to an altitude of 3,000 feet above sea level. It occurs in the form of a small spreading tree not more than 20 to 30 feet in height. Its long pendulous racemes of bright yellow flowers and fresh green leaves appear together in April. Sometimes a second flowering occurs in autumn also. Its long pendulous sausage-like pods, 1 to 1½ feet in length, ripen in the cold season. It is known as Konrai or Sharakkonrai in Tamil, Rela Chettu in Telugu, Konnai in Malayalam, Kakakayi in Kanarese, Soudhali in Bengali, and Amaltas or Kirvali in Hindi.

## Chemical examination

One kilogramme of the powdered bark was extracted with different solvents in succession

and the extracts so obtained were submitted to a chemical examination.

(1) *Petroleum ether extract*.—The red oily residue contained a small amount of a fat, a phytosterol and a red colouring matter.

(2) *Ether extract*.—The dark greenish-brown mass, which had a bitter and astringent taste, was found to contain an acidic substance which gave reactions resembling those of gallic acid but which could not be identified for lack of sufficient material. Oxyanthraquinone substances which appeared to consist of a mixture of emodin and chrysophanic acid from which no crystalline substance could, however, be separated were also present, in addition to a large amount of a dark-red substance of the nature of a phlobaphene and catechol tannins.

(3) *Absolute alcoholic extract*.—The dark-red mass consisted largely of phlobaphenes, tannins, reducing sugars and a small amount of oxyanthraquinone bodies. The latter seemed to contain substances of the same nature as were obtained in the ether extract.

(4) *Ash*.—The bark left on incineration 11.4 per cent of ash which was analysed and found to contain iron 1.42 per cent calculated as  $\text{Fe}_2\text{O}_3$ , calcium 1.69 per cent, carbonate, and silica.

An estimation for tannin by the A. O. A. C. (1935) method showed that the bark contained about 14.86 per cent of tannin.

## Method of extraction

The powdered root-bark was exhausted by percolation with cold 90 per cent alcohol and the percolate was concentrated under reduced pressure so that one millilitre of the final extract corresponded to one gramme of the bark. When this extract was sent out for trial, complaints were received from a few places that its administration produced severe nausea and vomiting. It was also noticed in the laboratory that, on keeping, a brown deposit had formed after about a month's storage. Examination revealed that it was due to the slow precipitation of resino-tannols and their oxidation products which might have caused the undesirable symptoms reported. After a series of experiments it was found that the use of 60 per cent alcohol for the extraction excluded a considerable proportion of these undesirable constituents without in any way affecting the therapeutic efficacy of the extract. Hence 60 per cent alcohol was employed as the menstruum in later extractions which were carried out as described below :—

One thousand grammes of the powder was exhausted with cold 60 per cent alcohol by the reserved percolate process. Eight hundred c.cm. of the percolate was obtained thereby to which was then added 100 c.cm. of glycerine and the final volume was made up to one litre with 60 per cent alcohol. The extract was filtered after keeping for a fortnight. Clinical trials with the extract thus made gave satisfactory results without producing the undesirable

\* Read before the Indian Science Congress held at Madras during January 1940.



symptoms reported in a few cases of the earlier series.

This extract was distributed to the district medical officers, East Godavari, Vizagapatam and Ganjam districts, the civil surgeon, Vizagapatam Agency, Vizianagram, and the Vizagapatam Agency surgeon, Koraput, for trials in cases diagnosed as black-water fever. The drug was tried in a series of 33 cases admitted in the different hospitals and dispensaries in the jurisdiction of the above officers. From the case-sheets received from the medical officers who treated these cases, the results obtained may be summarized as below :—

(a) Number of cases in which the drug was not retained due to vomiting ..	4
(b) Number of cases that ended fatally ..	1
(c) Number of patients who were cured ..	26
(d) Number of cases in which treatment with the drug could not be pursued for want of sufficient stock of the drug at the time the patients were admitted in the different hospitals .. .. .	2
TOTAL ..	33

The first four cases represent those that were treated with the drug prepared by the earlier method of extraction using 90 per cent alcohol as the menstruum. A full course of treatment could not be given in two cases, as the medical officers who attended on these patients ran short of the drug. So, only 27 cases were actually treated with the extract prepared by the modified method of extraction described above. Of these 27 cases, one ended fatally, the death having been due probably to the debility and anæmia produced on account of a prolonged fever. The remaining 26 patients recovered. In these cases hæmoglobinuria completely disappeared invariably in 3 to 4 days after the administration of a total quantity of the extract ranging from 12 to 16 fluid drachms, though in a few cases the urine had cleared the next day, and in one isolated case it took 6 days for the urine to become normal. The extract has been given, generally mixed with alkaline mixtures, in  $\frac{1}{2}$  to 1 drachm doses repeated every four hours, and in some cases even every hour or two according to the severity of the symptoms and the condition of the patient. No untoward effects were noticed in any of these cases. The number of cases apparently cured being 26 out of 27, the percentage of apparent cures worked out at 96.3 per cent. The medical officers who used the drug are of the general opinion that the results obtained were very satisfactory and that the drug can safely be used as a substitute for *extractum cassia beareana liquidum*.

In view of these results it is considered that this extract of *Cassia fistula* should be employed in the treatment of black-water fever on a more extensive scale.

Our thanks are due to the medical officers in the Ganjam, Vizagapatam and East Godavari

(Continued at foot of next column)

## A SEARCH FOR LATENT SYLVATIC PLAGUE IN CALCUTTA

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MEYER (1940) summarized the facts disclosed by the survey and experimental studies

(Continued from previous column)

districts for the interest and enthusiasm they evinced in conducting the clinical trials, for the infinite pains they took in preparing exhaustive case-sheets, and for the unbiased reports they have made.

### Summary

While searching among the indigenous species of the *Cassia* family for a substitute for *Cassia beareana* which is now being extensively used in the treatment of black-water fever, it was found that a therapeutically active extract could be prepared from the root-bark of *Cassia fistula*.

The extract is prepared by exhausting the powdered root-bark with cold 60 per cent alcohol by the reserved percolate process, the finished product containing 10 per cent by volume of glycerine and representing in every millilitre one gramme of the root-bark.

Out of the series of cases of black-water fever treated with the extract thus prepared, the percentage of cures worked out at 96.3. The urine cleared invariably in 3 to 4 days after the administration of a total quantity of 12 to 16 fluid drachms, the dose given being generally  $\frac{1}{2}$  to 1 fluid drachm, repeated every four hours.

[Note.—This report is very much more convincing than the usual run of reports on black-water specifics, and the tabular statement of the cases, which we were unable to reproduce on account of shortage of space, adds conviction to the report.

Black-water fever is a disease which seems to be particularly susceptible to cure by 'infallible specifics'. This is possibly because of the variability of the intensity of the attacks.

In a severe attack of black-water fever, there is a sudden very extensive hæmolysis of red cells. In an hour or so, all the damage is done. How, in such cases, does the specific act? One might as well look for a specific for a motor car accident! On the other hand, there are cases where the hæmolysis is less dramatic but continuous, and the specific may prevent further hæmolysis; and yet again there are others in which the damage done by the first hæmolysis is not irrevocable, but perhaps nearly so, and the specific may have some unusual diuretic action which makes the damaged kidneys start working again.

There is usually little information, or even suggestion, as to how the various specifics that are advocated for black-water fever act. In this sceptical age, empiricism is at a discount, though we admit that we know little about the action of many useful drugs.—Editor, I. M. G.]



conducted by the Hooper Foundation in co-operation with the United States Public Health Service and the California State Department of Public Health since 1933. These conclusions are of such great importance that the relevant sections are reproduced in full below :—

1. That plague of the wild rodents has been definitely recognized in 10 of the 11 Western States at least 1,000 to 1,200 miles inland from the Pacific Coast, the supposed portal of entry. It has invaded the Continental Divide and has been demonstrated close to the Canadian border.

2. That despite the widespread reservoir of plague only 9 human plague infections have been observed between 1933 and 1937; no infections were seen in 1938 and 1939.

3. That at least 18 different species of sciuridae, not less than 9 different varieties of citellus, 3 species of prairie dogs, 2 of marmots, 5 of field mice, pack rats and even cotton-tail rabbits were proved as hosts of *Pasteurella pestis*.

4. That *P. pestis* may exist as an inapparent, gross anatomically, even microscopically invisible infection which can be detected only by mass inoculation of triturated organ suspensions of the rodents into guinea-pigs. Latent plague infections were proven in squirrels, chipmunks, golden-mantled squirrels, wood rats, field mice, and flying squirrels.

5. That the invasiveness of the plague strains isolated from these latent infections is undiminished for mice and guinea-pigs, and of the same magnitude as that established for strains isolated from acute and subacute rodent and human infections.

6. That sylvatic plague persists indefinitely in regions in which it has appeared in epidemic form, and that the usual gross anatomical examinations of rodents may not detect the existence of plague.

7. That plague-infected but not necessarily infective fleas are found on a great variety of healthy rodents (even human habitations, donkeys) [sic] trapped or shot in plague areas. Surveys are greatly facilitated by the examination of pools of fleas collected from the rodents. Of the 26 species of fleas found on wild rodents only one-half are capable of transmitting the plague bacillus by bites.

In view of these important findings a search was made for the existence of latent plague in rodents caught in Calcutta. Wild rats caught in different parts of the city were examined. The methods employed are summarized below:—

Batches of live rats were collected from different parts of the city and killed by 'gassing' with coal gas. Individual batches varied from 8 to 12 rats. Fleas from each batch were collected and the spleens from the rats were dissected out and pooled. Suspensions of crushed fleas and spleens were rubbed on scarified skin (and in the case of the spleen suspensions injected subcutaneously also) into guinea-pigs and mice so that for each batch of rats 2 guinea-pigs and 2 mice were used. Later experiments showed that it was not essential to make dermal inoculations. The animals were observed for 7 to 10 days, when, unless death had occurred previously, the animals were sacrificed and the spleens of the guinea-pig and the mouse were ground up together and injected subcutaneously into a fresh guinea-pig and the animal watched for a week when it was sacrificed. Smears from the spleen of experimental animals were examined and cultures made from each spleen.

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## ERYTHROCYTE SEDIMENTATION RATE IN CHOLERA

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and

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THE erythrocyte sedimentation rate (ESR) has proved of the greatest use in the estimation of the activity or quiescence of chronic inflammatory disease. The mechanism of increase in the sedimentation rate is obscure, but experience has shown that the rate and amount of sedimentation is small when the destructive process is slight, and is markedly increased when the condition is active.

Cholera is characteristically an acute disease, and, though the organism has been known for many years and the disease itself subjected to much careful study, the mechanism of infection and the cause of death is still uncertain. Some claim that the disease is an allergic manifestation and others that it is a toxic process. It was felt that in a disease such as cholera, where there is great loss of fluid with consequent concentration and rise of specific gravity of the blood, the sedimentation rate would probably show no increase; and, conversely, that, if an increase was demonstrated, then the probability that cholera is a toxic process is greater, especially as Wolf (1924) found that the speed of sedimentation of erythrocytes in infants suffering from diarrhoea with toxic manifestation was accelerated, and that, when the diarrhoea was a mere local disturbance without general toxic symptoms, there was no change in the sedimentation rate. It was therefore considered of interest to determine the sedimentation rate in cholera, even though it was

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So far 200 rats collected in 22 batches have been examined with negative results for *P. pestis*; *P. septica* was isolated from two batches of 7 and 10 rats and *Bacterium typhimurium* (ætrycke) from three batches.

### Summary

Attention is drawn to the importance of latent plague in rodents and that infection of rodents with *P. pestis* can occur without any apparent gross lesions. This latent infection can be detected only by animal inoculation experiments. Although the results of the examination of a series of 200 rats have been negative for *P. pestis*, the findings of the work carried out in America are of sufficient importance to stress the necessity of further work on these lines. Further this survey must be extended to include other rodents.

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likely that the test would have no specific significance in diagnosis.

**Technique.**—Westergren's sedimentation apparatus was used. Exactly 0.4 c.cm. of a 3.8 per cent solution of sodium citrate in distilled water was drawn into a record syringe the needle of which was then introduced into a vein and blood drawn up to the 2 c.cm. mark. A tourniquet was used to facilitate venepuncture, but it was immediately released as soon as the needle was in the vein. The blood-citrate mixture was transferred to a sterile  $4 \times \frac{1}{2}$  inch test-tube and the test was put up within half an hour of collection.

The citrated blood after careful mixing was drawn up into a Westergren pipette which is calibrated in millimetres from above downwards so that the zero mark is exactly 200 mm. from the extreme point. The blood was drawn up to the zero mark, care being taken to avoid bubbles, and the pipette was placed vertically in its stand. The level of the red cell column was read after 1 and after 2 hours, so that the readings taken indicate the distance the erythrocytes sedimented from the zero mark in that time. The tests were performed at room temperature which averaged between 31 and 33°C.

Blood from 79 male cases of cholera was collected within 12 hours of admission to the cholera ward. In 21 of these the test specimen was taken immediately on admission and before any treatment had been administered; in 34 cases the blood was collected within 4 hours and in 24 within 12 hours of admission to the ward. In the latter two groups, hypertonic saline had been administered intravenously 1 to 3 hours previously to the patients in the first group and between 10 and 12 hours in the second group of patients.

No corrections on account of cell volume, hæmoglobin percentage, erythrocyte count, viscosity, temperature, etc., have been made. The hæmoglobin percentage of the first six cases was determined and found to be above 100 per cent in five and 84 per cent in one with the Hellige hæmoglobinometer; the erythrocyte count of the same six cases averaged from six to seven millions per c.mm.; also a few samples were put up for the sedimentation rate in parallel series, one being kept on the bench at room temperature and the other in the incubator at 37°C. No appreciable difference was noted in the erythrocyte sedimentation rate of the two series. These additional tests were done with a view to making corrections for these factors, but it was discontinued as it was considered illogical to correct for one or two factors while ignoring others. But controls were put up at the same time so that whatever personal and climatic errors influenced the tests influenced both equally. In this way a standard for comparison was obtained from 20 apparently healthy males which included Bengalees (16), Anglo-Indians (2) and Punjabis (2). The majority of these

were laboratory workers and post-graduate students.

The erythrocyte sedimentation rate of 17 of these apparently healthy males was 2 to 7 mm. in the first hour and 3 to 18 mm. in the second hour. The rates of sedimentation in the remaining three, who by clinical examination appeared to be perfectly healthy, though thin and slight of build, differed greatly from these and were 18 to 25 mm. in the first hour and 42 to 50 mm. in the second hour.

We have, therefore, some difficulty in fixing the ESR for normal healthy Indians. Muir (1929) reports that the sedimentation rate for normal Indians according to his technique was 10 mm. and 20 mm., the readings being taken  $1\frac{1}{2}$  and  $2\frac{1}{2}$  hours after setting up. Pasricha *et al.* (1941) report a range of 2 to 18 mm. (uncorrected) and Napier and Das Gupta (1941) 2 to 15 mm. in the first hour. If the mean and the standard deviation of the ESR of all the 20 apparently healthy Indians estimated by us is taken, then the figures obtained would be 20 mm. and 44 mm. for the first and second hours, respectively. If we were to accept these figures, the ESR of two of the exceptional individuals would still be outside the limits fixed as normal. But is one justified in including in a series such as this, where one is endeavouring to establish the sedimentation rate of normal healthy people, figures which by the standard obtained would be considered as abnormal? Under the circumstances, it has been decided to exclude these three individuals and the five cholera patients whose ESR were estimated at the same time.

Taking therefore as our standard for comparison the results obtained by the examination of the 17 apparently healthy people, namely, 2 to 7 mm. for the first hour and 3 to 18 for the second hour, the following results were obtained when the ESR of the 79 male cholera patients was estimated:—

TABLE I

*Giving the results of the ESR of 79 cholera patients: First hour readings*

	Number
ESR did not exceed 7 mm.	.. 26
ESR was between 8 and 14 mm.	.. 20
ESR was between 15 and 28 mm.	.. 17
ESR was between 29 and 60 mm.	.. 12
ESR was above 60 mm.	.. 4

It appears, therefore, from the results given in table I that the ESR in cholera is accelerated and the total fall is greater than that for healthy individuals in 53 (67 per cent) of 79 cases. In the remaining 26, which includes all types of clinical cholera, the ESR was apparently normal. Analysing these results further according to bacteriological findings, clinical condition, specific gravity of the blood and the influence of saline, we find that with the exception of the specific gravity of the blood there was no

special relationship with any of the above factors and the sedimentation rate.

It is evident that the presence or absence of vibrios has very little influence on the sedimentation rate. This is in agreement with the findings of other workers for other diseases, viz, that the test is not diagnostic.

The degree of the severity of the disease appears to have little influence on the sedimentation rate. There is apparently an increase in the sedimentation rate when there is toxic manifestation, but the degree of the increase does not increase *pari passu* with the severity of the attack. On the other hand, in

TABLE II

*ESR in relation to the bacteriological diagnosis of 79 male cholera patients*

	Not above 7 mm.	Between 8 and 14 mm.	Between 15 and 28 mm.	Between 29 and 60 mm.	Between 61 and 100 mm.
<i>V. cholerae</i> isolated ..	11	14	10	6	1
<i>V. cholerae</i> not isolated ..	15	6	7	6	3

TABLE III

*ESR in relation to the clinical condition of the patient*

	Not above 7 mm.	Not above 14 mm.	Not above 28 mm.	Not above 60 mm.	Not above 100 mm.
Fatal cases ..	1	2	..	1	2
Seriously ill cases ..	10	5	3	5	..
Moderately ill cases ..	10	8	7	4	2
Mild attacks ..	5	5	7	2	..

TABLE IV

*ESR in relation to the specific gravity of blood*

Specific gravity of blood	1054	1056	1058	1060	1062	1064
Specific gravity taken immediately before collecting specimen and before treatment administered.	ESR Accelerated 1 Not acc. ..	2 ..	1 ..	6 4	2 1	2 2
Specific gravity taken and saline given intravenously 1 to 3 hours previously.	Accelerated .. Not acc. ..	2 1	7 2	10 4	4 4	.. ..
Specific gravity taken immediately before collecting specimen but after saline had been given 10 to 12 hours previously.	Accelerated 6 Not acc. 1	6 2	.. 1	3 3	1 1	.. ..
Total ..	Accelerated 7 Not acc. 1	10 3	8 3	19 11	7 6	2 2
PERCENTAGE NOT ACCELERATED .. ..	12.5	23.1	27.3	36.7	46.1	50.0

TABLE V

*ESR in relation to administration of saline intravenously*

	Not above 7 mm.	Between 8 and 14 mm.	Between 15 and 28 mm.	Between 29 and 60 mm.	Between 61 and 100 mm.
No saline	7 (33.0%)	5	6	3	..
Saline given 1 to 3 hours previously.	11 (32.4%)	9	5	6	3
Saline given not earlier than 10 hours previously.	8 (33.0%)	6	6	3	1

this disease, the more severe the attack the greater the likelihood of the patient developing a high specific gravity of the blood with consequent slowing of the sedimentation rate. This is well illustrated in table IV.

The numbers in each group are much too small to allow of any deduction being made, though it is tempting to point out that, as the blood specific gravity of the cases rises, the number showing no acceleration of the sedimentation rate steadily increases. How far the rate is affected by the great loss of body fluid and the increased viscosity of the blood, we are unable to say. The cell volume of the blood of the patients with specific gravity 1064 was estimated and found to be from 60 to 66 per cent.

In two other patients not included in this analysis, blood for sedimentation was collected from one arm while hypertonic saline was being administered intravenously in the other. The sedimentation rate was 143 and 67 mm. for the first hour and 155 and 93 mm. respectively for the second hour. In table V it will be noticed that of the four patients whose ESR was between 61 and 100 mm. in the first hour, three had received saline 1 to 3 hours previously and one 12 hours previously, so that it led one to examine more closely what influence the administration of saline, intravenously, 1 to 3 hours previous to the collection of the sample had on the sedimentation rate. It will be observed that the percentage of cases showing no acceleration in the ESR in the group that received saline 1 to 3 hours previously is practically the same as that obtaining in the other two groups. The administration of intravenous saline, therefore, to male cholera patients 1 hour or more prior to collecting blood for ESR appears to have little effect on the sedimentation rate.

#### Summary

The ESR of 79 male cholera patients was estimated by the Westergren method.

There is an increase in the sedimentation rate of 53, or 67 per cent, of the 79 patients tested.

The higher the specific gravity of the blood at the time of testing for the sedimentation rate the greater is the number showing no increase in ESR.

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 (Abstract—*J. Amer. Med. Assoc.*, 1925, **84**, 407.)

*Note.*—The ESR of three of the controls that were excluded was repeated 2 years later; one was found to be 5 and 15 mm., the second 16 and 39 mm. and the third 8 and 20 mm. for the first and second hour, respectively. This last control is now known to be a diabetic responding well to dietetic treatment.

## THE STERILITY AND POTENCY OF INJECTABLE SUBSTANCES

### (ii) SALINES FOR INTRAVENOUS USE

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ALTHOUGH it has been conclusively shown by a number of workers that it is possible to avoid febrile and other undesirable reactions following parenteral medication, this is not realized by many clinicians and others responsible for the preparation of solutions intended for intravenous use. The reactions (characterized by chill and fever and at times even profound collapse) that occur after intravenous injection of salt solutions are dismissed as 'injection reactions', 'saline reactions', or 'non-specific', and are explained on various obsolete, complex, and unsubstantiated theories involving the doctrine of specific ion effect, hæmolysis, hydrogen-ion concentration, etc., or more often simply regarded as inevitable after-effects of intravenous therapy. It must be remembered that sodium chloride, sodium bicarbonate, or other ingredients present in different kinds of salines are physiological substances normally present in the blood stream and tissues of the human body, and have been shown, by themselves in the concentrations used, to cause no ill effects.

Recent work has shown that it is the water in which the various ingredients are dissolved that is the least suspected but often the most consistent cause of these reactions. Although it has been known for many years that intravenous injections of distilled water into animals may cause febrile reaction, it was not till the extensive and well-planned investigations of Hort and Penfold (1911) and later of Seibert (1923) that the nature of the fever-producing substance in water was discovered. These workers demonstrated that the reactions, following parenteral medication were due to 'contamination products' in the water used for the preparation of the solutions. A substance named 'pyrogen' (fever producer) was shown to be split protein products of certain bacteria which present in the air gain access to and rapidly multiply in water that is not kept absolutely sterile. The pyrogen develops rapidly and may be found in 2 to 4 days in distilled water kept in the ordinary open or partially open laboratory jars or containers. The pyrogen is soluble, filtrable, and thermostable except at very high temperatures. Further, unless scrupulous care is taken, pyrogens already present in the water that is being distilled can pass over with droplets

of water during distillation. To obtain water free from pyrogens it must be distilled in a still fitted with adequate arrangements to prevent the pyrogenic substances from being mechanically carried over into the distillate. Seibert (*loc. cit.*) has shown that all waters do not produce fever on injection and that there is a seasonal variability. Tap waters in certain seasons always cause fever whereas at other seasons they do not do so with the same regularity. Carter (1930) advocated a method of estimating pyrogen in water. This method (using potassium permanganate) which is based on the well-known principle of estimating organic matter in water has been shown by Banks (1934) and others to be not a true index of the pyrogen content. The most satisfactory method for the detection of pyrogen and the estimation of pyrogenic activity of water is by ascertaining the rise in rectal temperature of rabbits injected intravenously with measured amounts of water under test.

The importance of these observations in practical therapeutics has been realized by a number of workers and several methods of the preparation of pyrogen-free water have been advocated. Thomas and Ting (1938) stress the importance of pyrogen-free water in the preparation of saline for intravenous use in cholera patients. They describe a method of preparation which is both simple and cheap, and record 570 intravenous infusions of saline and glucose prepared with pyrogen-free water without a single untoward reaction. Injections were also given to over 1,600 cases of cholera without producing any reactions—a most creditable result. Keller

(1937) gives details of his method of preparation of saline. The method is efficient and economical, and the average time required for preparing 32 litres of saline solution, from the start to the capped bottled product, is approximately 3 hours. More recently Lees and Levvy (1940) describe a method for the emergency preparation of pyrogen-free water. The water is shaken for 15 minutes with powdered charcoal (1 gramme of charcoal per litre of water). The charcoal is then separated by decanting through a filter paper. This procedure is claimed to remove pyrogens from even heavily contaminated water.

In order to ascertain the quality of locally prepared salines intended for intravenous use, 12 samples of such salines were examined. The samples in original bottles or other containers were collected from those in actual use or issued for use. The sterility and the presence of oxidizable matter were first examined. As the results showed heavy bacterial contamination and the presence of comparatively large amount of oxidizable matter, the 'rabbit test' for pyrogen was not carried out with all the samples and is therefore not recorded.

The test for oxidizable matter was done according to a slight modification of Carter's method for pyrogen. A hundred cubic centimetres of water are heated in a scrupulously clean beaker (pyrex) and acidified with 10 c.cm. of 10 per cent sulphuric acid. The addition of 0.2 c.cm. of N/50 potassium permanganate imparts a pink colour to the mixture. If after boiling for 10 minutes the pink colour remains, the sample is pyrogen-free. The disappearance

*Results of the examination of 12 samples of salines intended for intravenous use*

Number	Type of saline	Container	Sterility test	Oxidizable matter in c.cm. of N/50 KMnO <sub>4</sub>	pH
1	Hypertonic	Glass-stoppered Winchester quart	(i) Spore-formers	1.8	8.0
2	Normal	Do.	(ii) Vibrios		
3	Hypotonic	Light-blue glass bottle (cheap quality) with two layers of gauze tied round the mouth.	Spore-formers	2.0	8.1
4	Normal	Enamelled mug with two layers of gauze tied round the mouth.	Spore-formers	1.2	8.2
5	Do.	Dark-brown glass bottle with well fitting screw-caps.	Spore-formers	2.8	8.2
6	Do.	Do.	(i) Spore-formers	0.8	8.1
7	Do.	Do.	(ii) Coliform group		
8	Do.	Dark-green glass bottle with a cork	Spore-formers	0.6	8.1
9	Do.	Light-green glass bottle with an ill-fitting glass stopper.*	(i) Spore-formers	0.6	8.1
10	Do.	Dark-green glass bottle with an ill-fitting glass stopper.*	(ii) Vibrios		
11	Do.	Dark-green glass bottle with a cork	(i) Spore-formers	1.2	7.7
12	Do.	Do.	(ii) Variety of cocci		
			Do.	0.4	8.3
			Do.	0.4	8.3
			Do.	1.0	7.9
			Do.	0.8	8.3

\*The glass stoppers in these two bottles were a mere excuse for a covering for the bottle. The bottles were not designed for use with glass stoppers. The glass stoppers were lying loose in the necks, and rattled on shaking the bottles. Bottles nos. 8 to 12 were of cheap quality of the type generally used for filling with kerosene oil.

of the colour indicates the presence of organic substances in the water. In the tabulated results is given the amount of N/50 potassium permanganate that it was necessary to add to each sample so that a definite pink colour persisted after 10 minutes of boiling of the mixture.

The organisms isolated were cocci of various types and the common sporing bacilli of the subtilis-mycoides group. From one sample Gram-negative bacilli were isolated. The number of bacteria in the different samples was not estimated, but all the samples gave positive results when 1 c.cm. of the saline was used as inoculum. The isolation of the inagglutinable vibrios was made from inoculums of 5 c.cm of the sample in peptone water. Both these samples of saline had been obtained from cholera wards.

Experiments designed to determine the source of oxidizable matter gave results which confirmed Seibert's findings and therefore need not be detailed here. The only additional point noted was that when the saline is distributed in cotton-plugged bottles or flasks and sterilized in the autoclave then a certain amount of oxidizable matter is found in the saline. This is derived from the cotton-wool. Similarly, if the saline is filtered during any stage of its preparation through cotton-wool then an appreciable amount of oxidizable matter can be detected in the saline.

Further comment on these results is unnecessary except to state that improvements in the methods of preparation, sterilization and storage in containers which will ensure sterility is necessary. The ordinary type of bottle with a glass stopper (unless the neck is protected by paper covering) is unsatisfactory. The simplest and cheapest method is to use screw-capped bottles in which the chances of contamination occurring at the mouth are minimized.

It would appear highly desirable to arrange for a central source of supply of saline intended for intravenous use. These centres which must be in charge of a competent staff would ensure the regular supply of saline and other products prepared from pyrogen-free water. It has been conclusively shown that distilled water kept under ordinary conditions is not necessarily as pure or as physiologically harmless as is usually supposed. This point cannot be emphasized too much or too frequently as it has been repeatedly demonstrated that pyrogen is the greatest and most constant single factor in the cause of reactions. Pyrogen can be eliminated by present-day methods and there is no need to run the risk of causing untoward reactions and of burdening the body. The intravenous use of saline has been termed 'life saving' in cholera, but with bad salines the results may not be so satisfactory. Thomas and Lih-Cheng Ting in discussing the importance of freshness of salines state 'the reports we have received from these

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## A FURTHER TYPE OF CHOLERAPHAGE —TYPE N

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IN 1929, d'Herelle, Malone and Lahiri (1930) described three different races of choleraphage; these were carefully studied and named types A, B and C by Asheshov (1930). Two years later, Pasricha, deMonte and Gupta (1932 and 1932a) reported three additional types (D, E and F) which were soon followed by types G, H and J reported by Morison (1933), and type K by Pasricha (1933). Type L was added to the list of choleraphage types by Anderson (1935), and a year later type M was described by Pasricha, deMonte and Gupta (1936). White (1937) in studying a choleraphage type (type L isolated in Calcutta and sent by one of us) came to the conclusion that it differed from the original type L of Anderson and in order to avoid confusion named it choleraphage LL. White made the interesting observation

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areas (areas at a distance and where fresh solutions were not available) that the response to injection was directly related to the freshness of the distillate. In one village the impression was that the mortality was higher in those infused than among the untreated'.

### Summary

The results are recorded of the examination of 12 samples of saline intended for intravenous use. These samples were picked up at random from those in actual use or issued for use.

All the 12 samples contained viable bacteria and comparatively large amounts of oxidizable matter.

Suggestion is made for the establishment of central laboratories that will undertake the preparation of pyrogen-free distilled water and salines for intravenous use for distribution. That there is a need for such a central organization is stressed by the results recorded.

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that egg-white lysozyme (egg-white used in 1 in 25 concentration) itself, without appreciable effect on the growth of the normal cholera vibrio, so enhances the activity of LL phage that visibly active filtrates may be obtained with regularity. Using this method, White found that all the fifteen Indian strains of *Vibrio cholerae* examined by him were infected with LL phage, whereas ten Chinese and Japanese strains of *V. cholerae* proved free of LL phage and were sensitive to its action. White also drew the attention to the possibility that LL phage was the most frequently occurring of Indian cholera phages and the probability that all the then-current cholera phage types were contaminated with LL phage.

In order to establish the exact nature of the cholera phage LL, a set of cholera phage types A to M was 'purified' from the contaminating LL phage by propagation and 'plaque isolation' on a Japanese Inaba strain of *V. cholerae* which was known to be free from any contaminating LL phage. A 'reciprocal cross-test' was done and phage LL behaved as a new type, the secondary culture obtained after the action of phage LL is lysable by the other twelve types (A to M) and LL phage acts on the secondary cultures obtained after the action of each of the other types. Because of this reciprocal activity LL phage is a new type of cholera phage and should be known as type N, thus bringing the known number of cholera phage types to thirteen.

Type N cholera phage resembles type A and stands out from types B to M in that it acts only on agglutinable vibrios (but not on the El Tor strains—ten such strains tested) and has no action on inagglutinable vibrios (165 inagglutinable strains isolated from cholera patients and waters tested). Because of its restricted action on *V. cholerae* type N is an important type for further study particularly as to its value in the classification of *V. cholerae*.

A series of 115 freshly-isolated strains of *V. cholerae* were examined for the presence of contaminating phage, and type N was found in only three of these strains. It must be noted, however, that the strains tested were all isolated within a short period and during the height of a cholera epidemic. Thirty old laboratory strains of *V. cholerae* were all contaminated with type N. These strains had been maintained for some years in the laboratory and included the strains examined by White. Five strains of *V. cholerae* from Hong Kong were examined for contaminating phages and three yielded type N, two were free, one of these was resistant and the other sensitive to the action of type N.

Type N cholera phage varies greatly in its activity, some races are feeble and unstable, and some produce a marked effect, but all belong to one type. This type appears to be best propagated either in the presence of egg-white lysozyme, or on solid or semi-solid agar.

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## AN INSECTARY COLONY OF *A. STEPHENSI MYSORENSIS*\*

By PAUL F. RUSSELL

and

BADRI NATH MOHAN

SWEET and RAO (1937) separated *A. stephensi* of Mysore into two biotypes, called *A. stephensi* (type) and *A. stephensi* var. *mysorensis*, on the basis of egg patterns. These observers found that the type form had larger measurements of ova as regards length, greatest breadth (including floats), number of ridges on float, and the proportion of the total length which is covered by the floats. They also noted that while the type *stephensi* was easily colonized, *mysorensis* failed to establish itself. The *mysorensis* females could not be induced to oviposit.

\*The observations on which this note is based were carried out as a part of the programme of Malaria Investigations, under the auspices and with the support of the International Health Division of the Rockefeller Foundation co-operating with the Health Department of Madras Presidency, the King Institute of Preventive Medicine in Guindy, Madras, and the Pasteur Institute of Southern India in Coonoor.

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Its further characters and its frequency in nature have not been as yet worked out.

### Summary

Cholera phage LL described by White possesses reciprocal action and is therefore a new type. In conformity to the nomenclature adopted for the naming of cholera phage types it is suggested that it be known as type N—the thirteenth type of cholera phage so far isolated.

Type N is an important type in that it acts only on *V. cholerae* and not on the inagglutinable vibrios. In its action which is restricted to *V. cholerae* it resembles type A.

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We obtained some larvæ of *mysorensis* from Sweet and Rao and compared the adults with some of the type forms from our insectary colony as regards susceptibility to experimental malaria finding no significant differences (Russell and Mohan, 1939).

We had had no difficulty in carrying along a colony of the type form (Russell and Mohan, 1939a) but failed in our first two attempts to colonize variety *mysorensis*. Obtaining a third lot of *mysorensis* from Dr. B. A. Rao, sent to Madras from Mysore, we have been able to colonize the variety. The purpose of this note is to report this success together with the significant fact that practically the same egg differences have appeared clearly through nine colony generations of *mysorensis* and about 60 generations of type *stephensi* (see table).

At first there was also some difficulty in getting male *mysorensis* to fertilize the females. Therefore we kept individual males and females in vials for several days, feeding the former on 10 per cent glucose water and the latter on rabbit blood. Numbers of celibate males and chaste females were then put together in a colony cage and mating occurred without much delay.

When, following this forcing technique, the first generation had gone through the aquatic stages and had emerged as adults, there was considerably less reluctance to mate and to oviposit and we have not found it necessary to repeat the special technique. The colony has progressed uneventfully through nine generations. Our colonizing technique has been fully described elsewhere (Russell and Mohan, 1939a).

TABLE  
Measurements of ova of *A. stephensi* type and variety *mysorensis*

Description	TYPE		<i>Mysorensis</i>	
	Present report	Sweet and Rao (1937)	Present report	Sweet and Rao (1937)
Length .. ..	540 ± 7.0	555 ± 24.0	500 ± 18.0	476 ± 24.0
Breadth .. ..	210 ± 4.0	204 ± 12.0	182 ± 9.0	160 ± 12.0
Number of ridges on floats ..	18 ± 1.1	18 ± 1.6	14 ± 0.8	13 ± 1.2

Note.—Length and breadth are given in microns. Breadth is greatest measurement, including floats. Sweet and Rao (1937) gave mean measurements expressed to two decimal places. In the above table they have been rounded off. The present report is based on 80 observations.

We found at first, in our third lot, the same reluctance on the part of *mysorensis* to lay eggs and therefore resorted to force to obtain ovipositing. Individual gravid females of *mysorensis* were placed in test-tubes. The side of a tube was gently knocked a few times and then, by vigorously swinging the tube, the female was flung into water in a petri dish inside a colony cage. If the legs of the insect became entangled in the water it usually began at once to oviposit. If not, it would fly upwards and the measure would be repeated. When ovipositing was completed the insect was lifted out on filter paper and it would fly to the side of the cage when the paper became dry.

#### Summary

*A. stephensi* var. *mysorensis* (Sweet and Rao, 1937) has been successfully colonized through nine generations and the distinctive ova measurements, which differentiate this variety from *A. stephensi* type, were observed in the ninth generation.

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## A Mirror of Hospital Practice

### TREATMENT OF A CASE OF SMALL-POX WITH SULPHONAMIDE-P

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A TEA GARDEN female labourer, aged 25 years, parity 5, delivered a male child normally on 11th May, 1940 (evening).

I attended her next day and found nothing but usual pelvic pain. The child was healthy. On 13th May, she had pain over the breasts and slight headache. Temperature 100°F., pulse 90, respiration 20 at 2 p.m. Bowels moved once, passed urine three times, tongue slightly coated and moist. I took it for 'milk fever'. I gave her one A.P.C. powder. Next morning she felt better but complained of backache. Temperature 98.4°F., pulse 88 and respiration 20 at 10 a.m.

On 15th May she had no fever but slight pain all over the body. Temperature 98.2°F., pulse 84,

respiration 22, tongue slightly coated and moist, spleen and liver not palpable, lungs and heart normal.

On 16th May she had fever with severe headache and pain all over the body. I was informed in the evening and attended her at 7 p.m., when she had temperature 99°F., pulse 100, and respiration 26. As there was a case of small-pox next door a fortnight earlier and there was an epidemic in this district I suspected it to be a case of small-pox but could not find any eruption owing to insufficient light. The child was well.

On 17th May I attended her at 9 a.m. when she had temperature 101°F., pulse 100, and respiration 28. I found the following:—Severe pain all over the body, swollen face with shotty papules. These were also present over the arms and legs but none on the chest and abdomen. I removed her to a segregation house with all her contacts immediately. The medical officer kindly attended her and confirmed my diagnosis saying that the duration was not more than 36 hours. With his advice I gave her two tablets of sulphonamide-P at 2 p.m. when she had temperature 102°F., pulse 110, respiration 30.

Two tablets of sulphonamide-P were repeated thrice daily for five consecutive days. Temperature began to come down after the first dose but pain continued till next day. At 6 p.m. temperature 101.4°F., pulse 108, respiration 32, and at 10 p.m. temperature 101.2°F., pulse 104, and respiration 32.

On 18th May the patient began to feel a little better. I found prominent vesicles on the face, arms and legs. They were circular and umbilicated.

At 6 a.m.	temperature 98.6°F.,	pulse 96,	respiration 26
10 "	" 98.4°F.,	" 94,	" 26
2 p.m.	" 98°F.,	" 94,	" 26
6 "	" 98°F.,	" 94,	" 26

On 19th May the patient felt much better, slight pain was present. Temperature sub-normal, pulse 90, respiration 24.

On 20th May the patient was getting better gradually. Temperature sub-normal, pulse 84 to 82, and respiration 20. I noticed that the vesicles of the face began to shrink a little; it was the fourth day.

From the next day all the vesicles began to shrink without pustules. Scabs began to form on the sixth day and they were complete by the ninth day. She had no rise of temperature. She was declared cured and discharged when all the scabs were fallen. She had no deep marks.

#### *The points of interest*

In this case temperature did not rise more than 102°F. on the second day when papules were seen. Temperature began to come down after the first dose of sulphonamide-P. There were no pustules. She had no secondary rise of temperature. Papules and vesicles were earlier. No deep marks were left after cure. It is to be noted that the patient was vaccinated a fortnight prior to her illness. Although the child was allowed to suck, he escaped the infection. The child was not vaccinated.

If it be taken into consideration that the disease started on 13th May, 1940, when I took it for 'milk fever' then why did the temperature come down to normal without any eruption?

Is this case modified by previous vaccination or the action of sulphonamide-P?

I should thank Dr. E. B. Rogers, the medical officer, and Mr. J. J. Macpherson, the manager, for their kind permission to allow me to report this case.

## VIPER VENOM IN A CASE OF RECURRENT HÆMORRHAGE IN THE VITREOUS

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and

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R. P., aged 50, a retired clerk, came to me walking with the help of his daughter, for total loss of vision in right eye and very little vision in left eye.

*History.*—The patient gave a history of having exposed himself to infection in May 1935. A copper coloured rash appeared in September 1935. He had neosalvarsan 0.15, 0.35, 0.75 gramme injections, at one-week intervals. Dermatitis and urticaria appeared after the second injection; still the course was continued with the result that he developed general oedema. Dermatitis was increased to weeping eczema, and the skin began to darken. He gave up this treatment, and started taking Ayurvedic medicines, when all these troublesome symptoms subsided. He took calcium lactate in December 1935 and believed that he was completely cured by April 1936. In June 1936 he got an attack of iritis in one eye; loss of vision in the other eye together with ataxia and constant urge to urinate also was noticed at this time. Urine when examined was found to contain albumin and pus cells. His eyes cleared under atropine and dionin. In 1937 iritis recurred and this continued till November 1938.

*On examination.*—Right vision: only projection of light. Left vision: fingers at one foot only. No conjunctival irritation, cornea in both eyes clear. In left eye pupil was contracted to 5 mm. due to adhesive iritis, no accompanying symptoms, no rise of tension in either eye.

*Dark-room examination.*—No red reflex in right eye. Perception of light was so poor that he could not see the bright nickel handles of the pantostat.

*Diagnosis.*—Right eye: vitreous hæmorrhage. Left eye: adhesions due to iritis; all due to syphilis.

Since November 1938 up to the date of report 18th November, 1940, he has been under my observation. His Wassermann reaction was done and found to be ++++. Urine trouble continued but no albumin, no sugar, no pus cells. For nearly one year he had the following treatment:—

Atropine and dionin in the eyes; right eye always dilated easily and fully, sub-conjunctival injections of normal saline, mercury inunctions, injections of bismuth preparations, Donovan's solution by mouth, and salicylic ionization for the eyes. Ataxia was noticed to be less after each ionization. No improvement in left eye. Vision in right eye improved to counting of fingers at 5 feet. Red reflex appeared. Trouble over urine continued till November 1939.

Though I knew that he had an idiosyncrasy for arsenic, in desperation, I gave him one injection of an arsenic preparation intramuscularly, novarsan 18 centigrammes. He again had all the symptoms of intolerance of arsenic previously noticed. But this time they were cured within a fortnight by salicylic ionization for skin trouble, calcium lactate and potassium iodide by mouth, and emetine injections. Vision in right eye improved to fingers at 10 feet but no change in left eye. Glasses were tried but they did not improve vision in either eye. In April 1940 he had hæmorrhage again in right eye (the same eye), red reflex was gone and vision was reduced to perception of light only.

As he had every kind of treatment that was indicated we were thinking if anything else could be given to prevent his total blindness in due course, when the

junior author suggested trying viper venom which was given as follows:—

Injections	Date, 1940	Doses, c.cm. (1 in 1,000)	Symptoms 24 hours after the injections
1st	7th June	0.1 diluted.	No local or general reaction.
2nd	11th June	0.2	Sense of well-being was reported, no reaction.
3rd	18th June	0.5	Temp. 101°, stiffness in legs, eye became very red, but the hæmorrhage was being absorbed as better view of the fundus could be obtained.
4th	25th June	0.6	More reaction both local and general.
5th	10th July	0.8	No trouble at all.
6th	25th July	0.8	Do.
7th	9th Aug.	1.0	Do.
8th	24th Aug.	1.0	Do.

At the end of August the right eye completely cleared up, but there was no change in the left.

Our findings on 17th November were as follows:—

*Right eye*—Conjunctiva clear; cornea clear; pupil dilated easily; anterior chamber clear; no signs of iritis.

*Fundus reflex*—Greyish, vitreous opacities—white bands seen running transversely and vertically.

*Disc*—Colour yellowish red, margin clear, lamina—cribrosa not seen clearly, vessels—arteries have become very thin, veins more prominent by contrast. Macula—a little pale, and blackish deposit round about. Vision—6/12 and with +2.50. J 3.

*Left eye*—Fingers at 2 feet. This eye is not useful.

*General examination*—Urine clear, blood pressure 135–85. Ataxia less, urinary frequency much less, no albumin, sugar, casts, or pus cells.

*The rationale of snake venom in therapy* (Chopra, 1936).—It contains the following active principles:—(a) Neurotoxin, (b) cytolsin and absorption of granulation tissue, (c) coagulative and hæmorrhagic enzymes, and (d) protective properties against rabies and epilepsy.

We are here mainly concerned with the cytolsin and coagulative enzymes, the two active principles. On account of the presence of these, venom possesses the property of absorbing granulation tissue and neoplastic protective cells, formed in the tissue, and it has been shown to retard the growth of tumour and cause metastasis to disappear. On account of the presence of coagulative enzymes it has been used in the treatment of menorrhagia, bleeding piles, purpura and hæmophilia.

We have not so far seen any reported case of recurrent hæmorrhage in the eye cured by means of snake venom. We therefore submit that on account of its coagulative property it checked further hæmorrhage and caused rapid absorption of the blood clot on account of its cytolsin and absorption of granulation tissue.

#### Summary

1. Eye infection started differently in the two eyes, in one iritis, in the other vitreous hæmorrhage, after one year of infection.

2. Antisyphilitic treatment for want of arsenic tolerance could not be pushed to its full effect.

3. Recurrence of hæmorrhage in the same eye.

4. Absorption of hæmorrhage from a body, in which there are no direct blood vessels, by Russell's viper venom, total 5 c.cm. of 1 in 1,000.

#### Conclusion

The injections of venom not only checked further hæmorrhage in the vitreous but caused a rapid absorption of the existing blood clot, and thus restored useful vision to the patient. We are aware of the fact that a solitary case only is quite insufficient to draw a general conclusion but we hope that others who have more opportunities will give a trial to it and thus help to come to a final conclusion.

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#### A CASE OF SCARLET FEVER

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RAKSHA, aged 7, had been having throat trouble for some time. Tonsillectomy was advised and it was suggested that she should have a course of sulphonamide before operation. In the last week of July, eight tablets of proseptasine were administered. Any idea of operation was given up for the time being and proseptasine was stopped. From the 27th to 30th August, eight tablets were again administered. She had low fever off and on. On 4th September the temperature was 100°F., with complaints of headache and pain in abdomen. There was constant and severe sore throat with marked dysphagia and furred tongue. Throat examination showed tonsils red and enlarged with follicular spots.

5th September.—Constipation; temperature rising up to 103°F., abdominal pain, dysphagia, exudate involving the anterior pillars of the fauces and back of the throat. Tongue furred showing reddened papillæ. A typical rash appeared—red flushed skin with punctate erythema; marked circum-oral pallor; very severe itching; and fairly severe vomiting. Fever, rash and vomiting with the previous history suggested sulphonamide poisoning and the throat condition made one think of diphtheria. Throat swab easily removed the exudate from follicles and the smear under the microscope was not suggestive of diphtheria. It showed chains of streptococci. Total leucocyte count was 12,000 per c.mm., differential count—polymorphonuclears 79, lymphocytes 13 and large mononuclears 8 per cent, thus agranulocytosis, a marked feature of sulphonamide poisoning, was ruled out. There was also absence of cyanosis.

Thinking over the whole case, signs and symptoms suggested scarlet fever to me but I could not reconcile it with prophylactic administration of sulphonamide. On questioning the doctor who made the differential count, I was informed that he did see a few eosinophils also. Blood picture, condition of the throat and tongue, rash and circum-oral pallor strongly pointed towards scarlet fever. Two other doctors attending the patient, however, did not agree.

6th and 7th.—Range of temperature 103°F. to 105.5°F. Severe itching, constipation, pain in abdomen,

backache and dysphagia were present. Tongue—tip and edges red and clear but otherwise coated, red papillae prominent—a typical white-coated strawberry tongue.

8th.—It was on this day that typical clear red-strawberry or raspberry tongue was seen. Fur had all peeled off leaving a clear tongue with prominent papillae. In the flexures of the elbows transverse lines of pigmentation in the creases of the skin were noticed and appearances suggestive of punctate hæmorrhage in the flexures of the elbows were also observed. At this stage we all agreed that it was a case of scarlet fever. Rash was not intensive or of long duration. Desquamation started by the end of the first week of illness.

Temperature touched normal on the morning of the 11th with a little rise in the afternoon but remained normal throughout on the 12th. In the 4th week of September epidermis of hands and feet was still peeling off. The patient being my own daughter and treated at home, it was possible for me to make detailed observations.

On 17th September, I was called in to see another similar case which showed all the clinical signs of scarlet fever. Source of infection could not be traced. In February 1940, one case of scarlet fever was reported occurring amongst British troops who had just arrived from the United Kingdom and were proceeding to Waziristan. In April, two cases of scarlet fever were reported amongst British troops in a different regiment. Diagnoses were based on clinical findings. No connection is traceable between the three cases occurring in Rawalpindi cantonment and the two cases occurring in September in the city.

No bacteriological or serological examination could be made.

It is believed that scarlet fever does not ordinarily occur in India. Municipal medical officers of health of Amritsar, Multan, Sialkot, Jullundur, Ferozepore and Ludhiana were asked if they had ever come across a case of scarlet fever in their towns, and all replied in the negative.

In 1924 the Director of Public Health, Punjab, reviewing the position in the Punjab concluded:

(1) The disease is apparently not endemic in either the hills or the plains of the Punjab.

(2) The rare instances in which scarlet fever has been detected in the Punjab have invariably been among Europeans, or Indians in closest contact with them; in the two cases reported no connection with Europeans could be traced.

(3) There is sure evidence that the disease is occasionally imported into the Punjab from abroad through the agency of postal matter; in the two cases reported no such connection could be traced.

(4) There is no known instance of importation of infection being followed by an epidemic amongst the indigenous population.

Scarlet fever is one of the group of widely different diseases the causative organism of which is a hæmolytic streptococcus. Hæmolytic streptococci are divided into types some of which are pathogenic to man but none of the conditions comprising the group of widely different hæmolytic streptococcal diseases is

due to one type only. Scarlet fever in one patient may be due to type 1, in another to type 2 and in a third to type 4. Scarlet fever and puerperal fever may be due to the same type. The group is composed of scarlet fever, infectious sore throat, erysipelas, and puerperal fever. The mode and portal of entry of the organism, general and local tissue resistance of the patient, invasive power of the infecting type of organism and its capacity to throw out rash-producing exotoxin, as well as susceptibility and resistance of the skin of the patient to this exotoxin, determine the clinical syndrome.

When a pathogenic type of hæmolytic streptococcus, capable of producing erythrogenic exotoxin, invades the fauces in a patient whose skin is susceptible, the clinical syndrome produced is the ordinary scarlet fever. The only difference between acute infectious tonsillitis produced by hæmolytic streptococcus and scarlet fever is the absence of the skin rash. This may be due to either resistance of the skin of the patient—shall I say Dick negatives—or feebleness of the hæmolytic streptococcus in producing erythrogenic exotoxin. Acute infectious tonsillitis is, I believe, pretty common. Rarity of scarlet fever may be accounted for by—

- (1) Resistance of the skin of Indians, *i.e.*, a very high percentage of the Dick negatives.
- (2) Rarity of the pathogenic strain of hæmolytic streptococcus capable of producing erythrogenic exotoxin.

The first is a problem for the public health worker to investigate and the second would be answered by a bacteriologist. I am informed that in 1937 some American authority got Dick tests done in the Mayo Hospital, Lahore, showing 34 per cent positive. I understand that toxin for carrying out further tests at the present moment is not available. Typing of hæmolytic streptococci requires typed sera. In the Punjab only the Research Institute, Kasauli, possesses these typed sera where typing is done.

## SPONTANEOUS PNEUMOTHORAX WITH A PLEURO-PERITONEAL FISTULA

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TUBERCULOSIS of the lungs in childhood is seldom reported in the medical literature in this country, but is not uncommon. The childhood type of tuberculosis, 'the primary complex of Ranke', is probably a comparatively rare occurrence, but the same cannot be said about the 'adult type' which is frequently met with in clinical practice. Many cases of the latter type are complicated with spontaneous pneumothorax. The case reported below is of peculiar interest inasmuch as a pleuro-peritoneal communication was established in a girl suffering from tuberculous pneumothorax.

### Case report

A Hindu female school-going child, aged 9 years, was admitted into the hospital on 30th November, 1940, suffering from pain on the left side of chest, and dyspnoea for 3 days. She had also fever and cough. The present illness started with fever 6 weeks prior to admission. It was at first slight in the evening only—later remittent ranging up to 104°F. There was cough with expectoration for 25 days. She never had hæmoptysis and there was no history of tuberculosis in the family.

*General examination.*—Thin, emaciated, orthopnoeic, slightly cyanosed, no oedema of the extremities, no enlargement of glands. On admission, temperature—98°F., pulse—130 and respiration—40 per minute.

*Respiratory system.*—No expectoration in hospital. Left side—bulging, restricted movement, hyper-resonant above and dull below, breath sound almost absent, metallic râles below. Right side—a few short râles in sub-apical region.

The heart was displaced to the right, its extreme end was in the fifth right inter-costal space just internal to the mid-clavicular line.

*Abdomen.*—The patient was doubled up. There was generalized rigidity over the abdomen; it was tender to touch; no mass was felt. The liver and spleen were not palpable. There was no vomiting; stools were passed daily.

Clinically she was diagnosed as a case of spontaneous tuberculous hydropneumothorax and possibly spontaneous pyopneumothorax with minimal involvement of right upper lobe. Peritonitis was also suspected.

X-ray examination on 3rd December confirmed the clinical diagnosis, both with regard to right and left lungs.

Blood examination on the 2nd: Hæmoglobin—50 per cent, leucocytes—14,500 per c.mm., polymorphonuclears—84 per cent, lymphocytes—10 per cent, monocytes—6 per cent.

*Subsequent history.*—On the 3rd, 400 c.cm. of air was withdrawn from the pneumothorax cavity (+12+4; -400 c.cm.; -2-12). She ran an intermittent temperature up to 101°F. By the 7th the lower part of the left side of her chest was oedematous, red and bulging. On the 8th an exploratory puncture brought out about 20 c.cm. of thick yellowish-white pus, which on staining did not show any acid-fast bacilli. Next day an attempt was made to draw out more pus. The pus was thick, and only a small amount came out in the syringe. Even on changing the level from the 7th to the 8th interspace, pus could not be aspirated. To reduce the positive pressure, another 400 c.cm. of air was taken out; pus flowed into the needle and interfered with the final reading. Her pulse was bad, and further attempt at aspiration was not made. She died 18 hours after.

*Post-mortem report.*—The right lung was emphysematous, and a small tuberculous focus was found at the apex. The left lung was tuberculous. There were about 10 ounces of pus in the left pleural cavity. The heart was normal. There were about 10 ounces of pus in the peritoneal cavity. The peritoneum was rough and showed signs of inflammatory reaction. There was a small tear in the oesophageal hiatus, through which the pus had probably travelled from the pleural to the peritoneal cavity. There was no sign of perforation in any part of the intestines, nor were there any signs of caseating glands bursting into the peritoneal cavity. On cutting open the whole of the intestines, a single circular ulcer was found in the terminal part of the ileum about one inch above the ileo-cæcal junction, and a few small punched-out ulcers were scattered around the ileo-cæcal junction. Pus from the peritoneal cavity and from the pleural cavity were both negative to acid-fast bacilli on Ziehl-Neelsen's staining. No animal inoculation of the pus was done.

*Discussion.*—Cases of spontaneous pneumothorax of tuberculous origin are found among Indian children. In some of them, there is

pyopneumothorax. The diaphragm being an effective barrier between the pleural and the peritoneal chambers, a pleuro-peritoneal pneumothorax is an extremely rare occurrence. An oesophago-pleural fistula in a case of tuberculous pyopneumothorax was however reported by Kanter and Madoff in 1937. Accidental pneumoperitoneum during artificial pneumothorax treatment was reported by Gaetan (1939) and Shrikhande (1940). But the author is not aware of any case being reported where the pus from the pleural chamber has burst into the peritoneal cavity. In this particular case pus was under tension, and found its way into the peritoneal cavity. Whether this had occurred prior to the admission of the patient into the hospital or whether it had occurred due to late aspiration of the fluid is debatable. On admission, the patient was doubled up and was complaining of pain in the abdomen wherever it was touched. The abdomen was rigid and peritonitis (from leakage of pus from the pyopneumothorax cavity) was considered a possibility. But the rigidity and tenderness persisted, or rather increased slightly, and a post-mortem examination was insisted on to make sure whether pus had entered the abdomen or not; and pus was found in the peritoneal cavity. Also it must be admitted that the level of the pus on the first day of exploratory puncture was distinctly at a higher level than that on the second day. It might be possible that there was a leakage of pus into the peritoneal cavity from the beginning and that, at a later date, the pus had rushed into the peritoneal cavity. This seems to be the possible explanation of the symptoms as they appeared. Another point of interest brought out by the post-mortem examination was the tuberculous ulceration of the ileum, which was never suspected clinically. This supports the view of many workers on tuberculosis that tuberculous ulceration of the intestines is more common than suspected.

### Summary

1. A case is reported where the pus from a pyopneumothorax cavity has burst into the peritoneal cavity through the oesophageal hiatus.
2. Tuberculous ulceration was present in the terminal part of the ileum, when clinically it was never suspected.

### Acknowledgment

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# Indian Medical Gazette

APRIL

## THE NEED FOR A CHEAP AND EFFICIENT ANTI-MALARIAL DRUG IN INDIA

THE irony of the present unsatisfactory position of cinchona cultivation in this country is that it was India who made the first successful essay at cinchona planting. Java's earliest efforts were so unsuccessful that in 1864 they almost gave up the attempt, at a time when cinchona planting in India was beginning to attract the attention of private commercial enterprise, and in 1880 India and Ceylon were each producing a million pounds of bark against Java's half million. From this date up to the end of the century cinchona production in these countries increased by leaps and bounds (Ceylon produced 16,000,000 pounds of cinchona bark in 1887), a state of affairs which led to a severe slump and the inevitable crash in cinchona prices at the end of the century. From this crash the Java plantations survived, whereas in India and Ceylon the cinchona industry, as a commercial enterprise, died.

There were some obvious reasons for the survival of Java, such as a slight but distinct climatic advantage and the scientific control to which their planting had always been subjected, but whatever the cause it is quite obvious that had the government moved in the matter the industry in India could have been saved. As it is, Java has to-day a virtual world monopoly in cinchona products. India grows in her government plantations cinchona enough to produce 70,000 pounds of quinine a year, her average consumption amounts to about 200,000 pounds and her real requirements are about 1,000,000 pounds of cinchona alkaloid. In 1914, at the beginning of the last war, India was seriously alarmed at the prospect that she might find herself short of cinchona alkaloids, and, with the very real possibility that the war may spread in the Far East, the position to-day can scarcely be any less alarming.

We have again and again in these pages urged the adoption of some forward cinchona policy. But, whilst the medical (including public health) authorities have always agreed upon the necessity for some further action, they have never been sufficiently importunate to persuade the government to take this action, and in India we are once again faced with an urgent problem which is not susceptible to quick solution, for, even if cinchona cultivation were extended immediately, it would be ten years before any appreciable results would accrue, and the worst pessimists have not suggested that the war will last another ten years! It is now however a war-time problem for which we are

seeking solution, though it seems to have taken a war to revive interest in it.

There is to-day a very healthy revival of interest in the pharmaceutical industry in India. In order to show that the word *revival* is not ill-chosen, we will again quote two paragraphs that appeared in the first volume of the *Indian Medical Gazette* in 1866:—

'We venture to indulge the hope that another septennial period will not pass away without our seeing the establishment of large chemical laboratories in each presidency—not mere repositories for the reception and distribution of imported drugs, or for the manufacture of a few tinctures, but pharmaceutical workshops on an extended scale, with highly qualified practical English Chemists attached to them—men who would analyse and test the products of the country; and make preparations, of what was valuable, in the most efficient way.

Government might well initiate such a system, leaving it for completion, as they have done tea cultivation, to the enterprise of companies or of individuals.'

With this general revival there is naturally an increasing interest being shown in the revival of cinchona cultivation. There are however two points of view, the commercial and the public health; these points of view are not incompatible, provided one does not completely dominate the other. Those who support the ultra-commercial point of view suggest that extensive cinchona planting should be undertaken with government encouragement, and if necessary support, so that eventually India will oust Java from the position of world monopolists. In other words, they would like to reproduce the state of affairs of the last slump, but, on this occasion, they will naturally demand, India must be saved by protection, or even subsidy.

This seems to us a wrong point of view. Our good friends, the Dutch in Java, have built up a splendid organization, and deserve the monopoly that they have acquired by science and industry. It should not be India's primary object to compete in world quinine markets, but, when there is evidence that she could supply the world's cinchona needs, it is absurd that she should not supply her own. But, if there is any extension of government cinchona planting, or if private enterprise is to be encouraged, the primary object, namely, the supplying of a cheap anti-malarial drug to the people, should be kept clearly in view and policy should be shaped to this end and to this end only. This again is no new policy for about the year 1874 when the government of Bengal replaced their low-quinine-yielding *Cinchona succirubra* by higher-quinine-yielding varieties, the Marquis of Salisbury, the Secretary of State for India at the time, emphatically condemned this policy. According to Wilson, *The Prospects of Cinchona Cultivation in India* (*vide infra*), his objection 'took the line that the object of introducing cinchona cultivation into India was not a commercial one but one having reference solely to the supply of a cheap febrifuge to the people of India. The question to be considered



was not what kind of bark fetched the highest price on the London market and was most sought after by quinine manufacturers but which kinds yielded the largest percentage of alkaloids which had been proved to be efficacious in the cure of fever'.

In 1928, the Royal Commission on Agriculture emphasized the importance of India's becoming self-supporting in the matter of her cinchona requirements and, in view of the emphasis that was laid on the urgency of this matter, it is surprising that 13 years later nothing material has been achieved. Again, in his Drugs Enquiry report of 1931 Sir Ramnath Chopra included the following recommendations:—

'The Cinchona Department should cultivate the species of cinchona best suited to the Indian climate, on a sufficiently large scale to make India self-supporting with regard to the alkaloids, and at prices commensurate with the economic condition of the Indian people.'

With a view to extending the cultivation of cinchona in India, experiments should be carried out in the growing of different varieties on a small scale in various areas, close connexion between the field and the laboratory being maintained'.

He also expressed the opinion that the 'factor which militates against the more extended use of quinine is its high price', and emphasized that the extensive adulteration and other dishonest practices associated with quinine were also due mainly to this high price. This report was issued nearly ten years ago and again what action has been taken on it, or on this particular aspect of it?

The argument may be put forward that cinchona cultivation is not the only aspect of the malaria-treatment problem and that there is the more difficult one of getting the drug to the people who need it. We do not close our eyes to this aspect of the problem, nor minimize its difficulties, but what we claim, and have repeatedly pointed out, is that the two problems are inextricably interwoven and are incapable of separate satisfactory solution. The main obstacle to the solution of the distribution problem is the high price of quinine, and the effect of this high price is a double-barrelled one; it naturally limits the amount of the alkaloid that the provincial governments can purchase for their hospitals and dispensaries, and it seriously complicates all attempts to distribute the drug free or at a reduced rate to the people. Quinine has a market value that is fixed by the monopolists in Java. This prevents the commercial sale of quinine by the quinine-growing provinces at a price lower than that of the market rate, except as a quixotic and foolish gesture that would benefit only the opportunist middleman, and, where free distribution is concerned, its high value places a serious temptation in the way of the many hands through which the quinine will naturally have to pass.

before it reached the ague-stricken peasant for whom it is intended.

It must be accepted therefore that the high price of quinine is a serious obstacle to progress. Can this price be lowered? The Bengal cinchona plantations and factories can produce quinine at about half the present world market price of this alkaloid, but the Indian plantations cannot in the present circumstances supply India's full requirements, so that the considerable balance has to be purchased from outside at world market prices. However, were we to extend our home cultivation, and there is evidence that this could be done, we could eventually become independent of outside sources of quinine and coincidentally of outside world prices, provided of course that we could prevent profiteering by exportation. This, however, would only get us over half our difficulty for the price would still be relatively high.

Could the price be lowered still further? Possibly the price of quinine could not: we do not know, but we do know that a preparation of mixed cinchona alkaloids could be produced at a very much lower price. In Manila Dr. Paul F. Russell reported that the Bureaux of Science, Forestry, and Prisons, in collaboration with the Rockefeller Foundation, have shown that an excellent preparation of mixed cinchona alkaloids of the totaquina standard could be prepared at a cost one-seventh that of quinine. If this could be done in India, and we have every reason to believe that it could, the problem of the treatment of malaria in this country would have travelled a very long way towards solution.

The first question that will naturally arise is, Is a mixture of cinchona alkaloids as good as quinine as an anti-malarial drug? The answer is that any mixture of cinchona alkaloids is not necessarily as good as quinine, but that one satisfying the 'totaquina' standards is as good, or very nearly as good, as quinine. The most unfavourable interpretation that has been given to the term *very nearly* is ninety-five per cent; usually the relative value of totaquina as an anti-malarial drug as compared with quinine is placed at a higher level than this, and there are many who believe that the mixed alkaloids are more efficacious than quinine in certain forms of malaria.

The totaquina standard was originated by the Malaria Commission of the Health Organization of the League of Nations as being an efficient anti-malarial drug that could be prepared from the harder cinchona plants in the form of a preparation of crystallisable alkaloids mixed in the proportion in which they occur in the plant. This standard was universally accepted, it appeared in the *British Pharmacopœia* 1933, and subsequently in many other national pharmacopœias. At the suggestion of this Commission trials with this preparation were carried out in a number of countries, in



India, Malaya, Roumania, Algeria, Formosa, China, and the Philippines, and in every instance its efficacy has been confirmed.

A question that will naturally arise in the mind of the critical observer is, If the mixed cinchona alkaloids are so satisfactory, why, after using mixed alkaloidal preparations for many generations, did the medical profession turn away from them and express a preference for the pure alkaloid quinine? That they did give the lead in this matter is obvious. The explanation is not difficult and does not entail any indictment of our predecessors. When the chemist separated and identified the various alkaloids in cinchona bark, the scientific mind of the medical profession naturally wished to know which of the many alkaloids that it contained was the most efficacious; investigation showed that, on the whole, quinine was the most effective alkaloid in the treatment of malaria, so that quinine became the alkaloid of choice and therefore the most valuable one; consequently the grower and the manufacturer took up their cue and aimed at growing only the high-quinine-yielding varieties and manufacturing only quinine. The former tendency was all to the good, provided it did not entail the limitation of planting areas; the latter was not so beneficial for it meant that the other alkaloids for which there was little demand were virtually wasted and the price of quinine had to be raised to compensate for this loss. One measure that the manufacturers adopted to avoid this loss had an even more unfortunate repercussion; having removed the more valuable alkaloids, including the quinine, they marketed the balance of mixed alkaloids as cinchona febrifuge. Not all cinchona febrifuges were bad, but many contained little more than the almost inactive amorphous alkaloids and were practically useless in the treatment of malaria. The natural result was that the medical profession turned more firmly towards the pure alkaloid quinine whose action could be relied upon every time, and cinchona febrifuge acquired a very bad name, which it has not yet been able to live down. The standardized product, totaquina, is an entirely different proposition; it has not had its valuable alkaloids removed, and it does not contain more than a minimum of the viscous amorphous alkaloids that tend to make the tablets hard and insoluble. The *British Pharmacopœia* standard for totaquina demands that it shall contain at least 70 per cent of crystallisable alkaloids of which at least 15 per cent shall be quinine, and that it shall not contain more than 20 per cent of amorphous alkaloids, 5 per cent of water, and 5 per cent of ash and mineral matter. An alkaloidal mixture of this standard can be made from the total alkaloids of the hardier and hybrid species of cinchona without the separation of the individual crystallisable alkaloids or the addition of extra quinine; thus, not only is the usable alkaloidal output very much greater than it

would be if only quinine were separated, but the process of manufacture is simplified.

Two criticisms have been raised, and by people in responsible positions who should have known that their objections were frivolous; the first is that proper standardization of total alkaloid mixtures would necessitate the prior separation and purification of the individual alkaloids and subsequent mixing, so that the cost of manufacture would be unaffected, and the second is that, once the value of the other crystallisable alkaloids is appreciated, their price will automatically rise to that of quinine. The latter argument we can dismiss as being the ultra-commercial point of view, and not very sound at that. The degree of standardization that is envisaged in the first criticism is entirely unnecessary; the wide margin allowed in the preparation of *British Pharmacopœia* totaquina was designed to obviate such accurate and expensive standardization, and the raising of this objection seems to us to be an attempt to perpetuate a mistake that has already been made. We remarked above that we could explain the apparent reversal of medical policy during the last seventy-five years without criticizing our predecessors; we might perhaps qualify this by adding 'on scientific grounds', for we must criticize them on the grounds that they failed to face realities; they created the pure-quinine cult without realizing where it would lead to. They perhaps could not have foreseen this, but for very many years it has been only too apparent and they should have been ready to call a halt. For generations—for a century or more—powdered cinchona bark was used as an anti-malarial drug and proved a very efficient one; we are not suggesting that we should have been satisfied with this and not have tried to find something better, but wasn't it going a little too far to insist, and to teach generations of doctors and eventually the public, that only this one alkaloid, quinine, was of any real value in the treatment of malaria, and thereby to raise its price out of the reach of the peasant and to such a level that government dispensary budgets could not afford to purchase for distribution to their patients more than a tithe of the amount that is really required. We are not suggesting that we should go back to powdered bark—though this would be better than the quinine-less 'quinine mixtures' that are sometimes dispensed—but that as we now have a preparation of mixed alkaloids that, in the opinion of many, is as good as and often better than quinine, we should prescribe it whenever possible, and that in government hospitals and dispensaries quinine should be given only in the very exceptional cases where this specific alkaloid is indicated.

We said above that no material action had been taken on the recommendations of the Royal Commission on Agriculture; this is, we believe, true, but in 1937 on the recommendation of the Indian Research Fund Association

through the Central Advisory Board of Health and with the approval of the Governing Body of the Imperial Council of Agricultural Research, the Government of India appointed an officer 'to determine what areas in India are most suited to cinchona cultivation and what would be the cost of production in such areas'. The terms of reference of this inquiry do not seem to be particularly explicit and the fact that the primary object of the recommendation was a medical one seems to have been lost sight of in its passage through the various bodies; there is at any rate no evidence that Mr. Wilson, who undertook this enquiry, ever consulted malariologists, or any other medical authorities, before commencing his investigations or making his recommendations on a subject which, as we have said, is basically a medical one. The incident seems to have been a particularly bad example of water-tight departmentalism; an invaluable opportunity has been missed of constituting a combined medical, chemical and agricultural committee. As it is, the report that has been produced, though an extremely interesting one and no doubt very valuable from an agricultural point of view, has taken us not a yard nearer the solution of the vital problem of providing a cheap anti-malarial drug for the people of India, because the writer had no idea what the real medical and public health requirements were, made no attempt to find this out, and in fact viewed the whole matter entirely from the commercial point of view. In support of this criticism we need only quote a paragraph that appears at the very beginning of the report proper, after the historical survey:

'In this investigation it is the land considered suitable for *Cinchona ledgeriana*, that has been selected. *Cinchona ledgeriana*, when properly cultivated, yields the most profitable return because it contains the maximum quantities of quinine. To recommend any other variety in preference would go against the verdict of history.'

The commercial spirit that is reflected in this paragraph and the false premise—which he appears to have made no attempt to check—that the medical profession is only interested in the alkaloid quinine, have steered his enquiry into sterile channels, sterile as far as the malaria treatment problem in India is concerned. The last paragraph of his summary and recommendations, if it has any meaning at all, is in no sense a conclusion but merely a reiteration of this premise, for it appears to have no direct reference to anything contained in the report:—

'In the meantime, pending the arrival of more workers in the cinchona field, it would be correct to say that the interest for India lies in the hope of plentiful supplies of quinine rather than the prospect of increasing supplies at mass production rates.'

Mr. Wilson refers to the verdict of history. May we remind him that the adoption of an ultra-commercial policy, in which the needs of the people take second place, has already called forth a rebuke from a famous Secretary of State? It is not beyond the bounds of possi-

bility that future historians may record how those who pursued this policy received a similar rebuke from a famous Viceroy.

There are two ways in which the governments in India could set about this problem; they could extend their present plantations, still growing the high-quinine-yielding *Cinchona ledgeriana* in areas suitable for its cultivation, but not limiting their planting to such areas and growing hardier species, such as *Cinchona robusta*, in other areas unsuited to *ledgeriana* cultivation, and in their factories manufacture a large preponderance of totaquina and smaller amounts of pure alkaloids; and/or they could encourage private enterprise in cinchona cultivation, and possibly in cinchona alkaloid manufacture.

It has been suggested that the governments should subsidize concerns prepared to grow cinchona; this, we consider, should be entirely unnecessary, for the capital outlay is not great and, if the price of bark is maintained, it should be a very profitable industry. It will be noted that there is an 'if' here, and this is where the government could assist. We are informed from a reliable source that if the government would guarantee a price for bark, not less than half the present price, cinchona planting would provide a profitable return. We cannot claim to have any expert knowledge in such matters, but surely, if the government can exercise any effective control over fully-grown industries, such as tea and jute, they could control the growth of what would be virtually a new industry.

A suggestion was recently made by a small neighbouring State which has a great deal of land suitable for cinchona cultivation, that they should introduce cinchona cultivation as a cottage industry; as it would be nearly ten years before they could expect any return for the outlay and work, the State authorities naturally did not wish to encourage their subjects to undertake this, unless an adequate price for the bark could be guaranteed. This is surely the type of enterprise that deserves encouragement. The cottage industry suggestion might well be adopted in provinces in British India, such as Assam.

Our readers may say what has all this to do with us? How can we influence government policy? Even if we put aside the fact that, in a country governed on democratic principles, every voice that is raised helps to influence the government, there are more direct ways. The demand for pure quinine, which has indirectly been the cause of so much trouble, originated with the medical profession, and it is from them that the demand for the standardized mixture of the alkaloids (or totaquina) must come. We have repeatedly pointed this out, and there is evidence that the teaching of those who share with us this point of view has borne fruit and that the

demand for cinchona febrifuge is outstripping production, for a circular was recently issued by the Bengal Government limiting the amount of cinchona febrifuge that can be ordered for dispensaries and hospitals to fifty per cent of the total anti-malarial drugs, the balance being made up of quinine. This, we sincerely hope, is only a temporary measure to meet the present situation, for it would be a tragedy (not to say

a crime) if it indicated that the finance departments were demanding that hospitals and dispensaries with their limited budgets should purchase the more expensive drug, in order that the government could swell their profits.

We feel very strongly that no real progress will be made in this matter until the commercial is made subservient to the medical point of view.

## Special Articles

### HÆMATOLOGICAL TECHNIQUE

#### PART X

By L. EVERARD NAPIER, F.R.C.P. (Lond.)

and

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#### (16) The red cell fragility test

*Introduction.*—When normal red cells are suspended in 0.85 per cent saline they remain unaltered, but they become crenated when the concentration of the saline is raised above 0.9, whereas they are hæmolyzed, or 'laked', when the concentration is lowered below 0.45 per cent.

The study of the reaction of the red cells in hypotonic saline solution is known as the fragility test of the red cells. The test can be done by either a qualitative or a quantitative method; it is conveniently done with fresh oxalated venous blood collected for routine examination of the blood (part I), but it can also be done with ordinary (non-oxalated) venous blood, or with the capillary blood from the finger.

The fragility of the red cells is expressed in terms of percentages of sodium chloride solution, namely, the points at which hæmolysis commences and at which it is complete.

#### Qualitative method

To each of a series of numbered test-tubes containing saline solution of different graded concentrations, one drop, or two drops of blood are added; the contents of the tubes is mixed

#### Example.—

Numbers on racks opposite test-tubes	..	..	W	12	13	14	15	16	17	.	.	.	.	24	S
Number of drops of 0.5 per cent NaCl to be put into each test-tube			0	12	13	14	15	16	17	.	.	.	.	24	25
Number of drops of distilled water to be added to each test-tube			25	13	12	11	10	9	8	.	.	.	.	1	0

well and allowed to stand for about 2 hours, after which the numbers of the two tubes that show the beginning of hæmolysis and complete hæmolysis are noted, and from these the strengths of the corresponding saline solutions are calculated.

#### Apparatus and reagents required

- (i) Accurate solutions of sodium chloride, 0.5 per cent and 1.0 per cent, standardized against silver nitrate solution.
- (ii) Small test-tubes.

(iii) Metal rack for holding the tubes.

(iv) 5 or 10 c.cm. syringe with needle of fairly wide bore.

A convenient form of rack is that used for the Wassermann reaction. The holes are in two rows, with single tubes at either end of the rack. The holes are numbered 12 to 24 and those at each end 'S' and 'W' (figure 1).

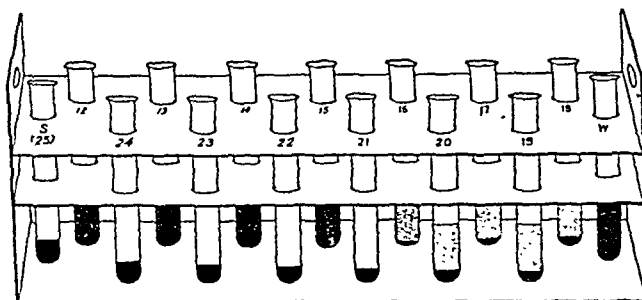


Fig. 1.

#### Technique

With a syringe fitted with a needle of fairly large bore, put into each tube the number of drops of 0.5 per cent sodium chloride solution indicated by the number on the rack opposite that tube, and 25 drops in the tube marked S.

Wash out the syringe thoroughly with distilled water. With the same needle, add a sufficient number of drops of distilled water to bring the total number of drops of fluid in each tube up to 25, and 25 drops of distilled water in the tube at the end of the rack marked W.

Shake each tube thoroughly to get a uniform mixture. To each tube add one drop, or two drops if the patient is very anæmic, of blood with a syringe, either directly from the patient or from the oxalated blood in the flask. (If great accuracy is aimed at, the test should be performed with washed red cells, as the red cell is protected from saline hæmolysis by its own plasma.)

Shake all the tubes again. Place the rack with the tubes on a flat even surface and allow

it to stand for about 2 hours at room temperature. If there is any special need for hurry, centrifuge all the tubes for about 10 minutes and take the readings at once. If possible, put up a parallel test with normal blood as a check to the accuracy of the sodium chloride solution.

**Reading the results.**—Hold the rack with the tubes level with your eyes against daylight. Note the number of the tube in which hæmolysis is first shown and also the number of the tube in which it is quite complete. Examine the tubes commencing from tube no. 25 and proceed towards the other end; the first tube showing a tinge of reddish colour in the supernatant fluid indicates the beginning of hæmolysis and the first tube in which all the corpuscles are laked and no corpuscular residue is visible, even after centrifugalization, indicates the point of complete hæmolysis.

The result is expressed as percentage of sodium chloride solution and is calculated by multiplying the figures on the tubes by 0.02.

#### Example.—

The first tube in which the supernatant fluid shows any pink colour is numbered 20.

The first tube in which there is no corpuscular residue is numbered 15.

Therefore, hæmolysis begins at  $20 \times 0.02 = 0.40$  per cent saline.

hæmolysis is complete at  $15 \times 0.02 = 0.30$  per cent saline.

When the test has to be carried out with very fragile cells, e.g., in acholuric jaundice, concentration of sodium chloride of over 0.5 per cent may be required; in such a case use one per cent solution instead of 0.5 per cent and proceed with the test in the same way as before. Take the readings, and multiply the numbers on the tubes by 0.04 to get the percentage of the saline.

Normally, partial hæmolysis begins at about 0.44 per cent, and is complete at about 0.30 per cent saline.

#### Quantitative method

The 'qualitative' method would be quite accurate if all the cells in any particular sample were of the same fragility, but the individual cells vary in their fragility just as they vary in their size. It is therefore important to know what percentage of cells have been hæmolysed by each solution. This quantitative method is more laborious, but is worth doing in special cases.

**Principle.**—A number of accurate red cell counts are done in the usual way except that instead of the standard diluting fluid different strengths of salt solutions\* are used; from the results an accurate quantitative graph of the fragility is plotted.

\* Simmel (1923) used mixtures of salts identical with those in the blood, but Whitby and Hynes (1935) obtained identical results by using sodium chloride solutions; we recommend the latter method on account of its simplicity.

#### Apparatus required

As in red cell count (part II).

Also, accurate solution of sodium chloride (standardized against silver nitrate solution) from 0.3 to 0.7 per cent with intervals of 0.05 per cent.

**Technique.**—Fill red cell pipettes as in the red cell count using different strengths of salt solution ranging from 0.3 to 0.7 per cent with intervals of 0.05 per cent. Allow the pipette to stand on an even surface for about 15 minutes, shake it well, and then count the red cells in the usual way (see enumeration of red cell, part II).

Repeat this count with each solution and include a control with the usual diluent.

From the above counts calculate the number of cells that become hæmolysed in different strengths of the salt solution and plot a curve. The normal limit of fragility of the red blood cells, as determined by the quantitative method of Whitby and Hynes (1935), is shown in figure 2.

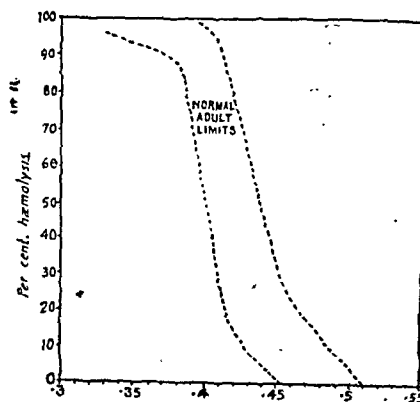


Fig. 2.—Fragility of red corpuscles as determined by quantitative method (Whitby and Hynes, 1935.)

#### Discussion

The fragility test is based on the assumption that there is some parallelism between the fragility of the erythrocytes *in vitro* and their susceptibility to hæmolysis *in vivo*. Though it is very unlikely that the mechanisms of these two processes, neither of which is fully understood, are identical, there is the evidence that in certain conditions, e.g., acholuric jaundice, where the red cells are particularly liable to hæmolysis *in vivo*, they are hæmolysed by hypotonic saline solutions that would not affect normal erythrocytes.

In the physiological process of red cell demolition, there is some evidence that the red cell, normally a biconcave disc, becomes more spherical in shape before it disintegrates, and in many 'hæmolytic' anæmias it has been shown that the red cells are more spherical than the normal red cell. These spherical cells appear to be more susceptible to hæmolysis by hypotonic salt solutions, but it is certain that this is not the only change that brings about this increased fragility.

In all cases of obscure anæmia it is certainly worth carrying out the fragility test, by the quantitative method if this is feasible, not only

in the interests of accurate diagnosis but in order to add to our knowledge of the ætiology of the many types of anæmia about which our knowledge is incomplete.

(17) *Procedures employed in investigating hæmorrhagic diseases*

*Introduction.*—In the study of hæmorrhagic diseases and hæmorrhagic diatheses, a number of procedures are commonly carried out that should be included in this series on hæmatological technique. These are:—

- A. Estimation of the coagulation time.
- B. Estimation of the bleeding time.
- C. Quantitative estimation of prothrombin in the blood, or determination of prothrombin time.
- D. Capillary resistance test.
- E. Study of clot retraction.
- F. Platelet count (*vide* part III).

The study of clot retraction gives little additional information of value, as it appears to be dependent entirely on the platelet count, but, as it provides confirmatory evidence, we have included it. The estimation of blood calcium also has some bearing on this subject, but is essentially a biochemical test and will not be described here; further, though calcium deficiency could theoretically lead to a hæmorrhagic state, in actual practice it does not appear to do so, unless associated with other deficiencies.

*Discussion.*—Briefly stated, and essentially, coagulation of the blood is dependent on fibrinogen, ionized calcium, prothrombin and thrombokinase (thromboplastin). The first three are present in the plasma, while thrombokinase is derived from the disintegration of the platelets and damaged tissue; the chain of events is as follows:—

Prothrombin + ionized calcium + thrombokinase (thromboplastin)  $\rightarrow$  thrombin.

Thrombin + fibrinogen  $\rightarrow$  fibrin.

Fibrin + cellular elements of blood  $\rightarrow$  blood clot.

Clot + platelets  $\rightarrow$  the retracted clot.

(This leaves out of account the interaction between anti-prothrombin, prothrombin, and thromboplastin substances. Heparin—anti-prothrombin—is a very real substance, but whether it exists in the circulating blood in health does not seem definitely established, so, for the sake of brevity and, we hope, clarity, we have not considered the part it may possibly play in preventing clotting in the circulating blood.)

All the above substances are normally present in the blood and a defect in any of them will cause a break in the continuity of the chain, and will lead to hæmorrhage.

Known causes of the hæmorrhagic state are:—

- (i) Deficiency of platelets (and consequent deficiency of thrombokinase), as in thrombocytopenic purpura.
- (ii) A defect of the platelets so that they do not disintegrate at the usual rate, as in hæmophilia.
- (iii) A deficiency of prothrombin in the blood, as in vitamin-K deficiency.

(iv) Fibrinogen deficiency, as in prolonged chronic hæmorrhage.

(v) A defect in the capillary walls, as in vitamin-C deficiency.

In (i) there is a decrease in the platelet count, a normal coagulation, but a prolonged bleeding time, and poor clot retraction; the prothrombin is normal.

In (ii) the bleeding time is normal and the coagulation time is prolonged.

In (iii) the bleeding time is normal and coagulation time prolonged; prothrombin is decreased, but the clot retracts normally.

In (iv) the bleeding time is normal and coagulation time prolonged; and the clot retraction is defective, but prothrombin is normal.

In (v) the bleeding time is prolonged and the 'capillary resistance' is decreased, but the coagulation time, prothrombin and clot retraction are normal.

#### A. Coagulation time

Various methods have been described for the determination of the coagulation time, but it is essential to adopt one method and to follow the technique as uniformly as possible, for the normal coagulation time varies very considerably with the technique, with the temperature, and with the diameter of the tube used; it is also influenced by admixture of the blood with tissue juice or any other foreign substances. It is advisable first to determine the coagulation time of a few normal persons in each laboratory; all subsequent examinations must be done exactly in the same way and the results interpreted in relation to the normal findings.

Two methods are described, as we have had considerable experience with each.

#### I. Capillary tube (Wright's) method

##### Apparatus and reagents required

- (i) Fine capillary tubes, with diameters from 0.8 to 1.2 mm. and six inches long.
- (ii) Pricking needle or blood gun.
- (iii) Water-bath, or warm water in a beaker at 30°C., with a thermometer.
- (iv) Spirit lamp.
- (v) Stop watch.
- (vi) Alcohol.
- (vii) Ether.
- (viii) Cotton-wool.

*Technique.*—Clean a finger or an ear lobe, first with alcohol and then with ether. Puncture sharply and fairly deeply with a blood gun or a pricking needle, so that blood will flow freely without the necessity of squeezing. Discard the first two drops of blood, and then fill a capillary tube up to three-fourths of its total length with blood (the capillary tube will fill by capillary attraction when held against the drop of blood). Note the time by the stop watch when the blood first enters the capillary tube. Seal the free ends of the tube in a flame and put it in warm water (37°C.) in a beaker. Repeat the process with two other tubes, noting the time of the commencement in each case.

After one minute, take out the first tube, gently break off a portion of the tube from one end, and repeat this every 15 seconds until a thin line of unbroken coagulum is seen stretched between the two broken ends; note the time. The difference between the two times by the stop watch is the coagulation time. Repeat the procedure with the other two tubes, breaking them at intervals of 15 seconds, and find out the coagulation time for each tube.

Take the mean of the three readings as the coagulation time.

Normal time limits = 1 to 3 minutes.

## II. Method of Lee and White (modified); with venous blood

*Apparatus and reagents required (additional)*

- (i) An all-glass 5 c.cm. syringe, with a needle of fairly large bore.
- (ii) Small test-tubes  $\frac{1}{4}$  inch in diameter with rubber corks, in a rack.
- (iii) Normal saline.
- (iv) Hard paraffin in a metal or porcelain bowl.

Prepare a water-bath at 37°C. and the paraffin tubes; place the paraffined tubes ready in the bath in an upright position.

Collect 5 c.cm. of blood from a vein in an all-glass syringe immediately after washing it out with normal saline. Note the time by the stop watch when the blood enters the syringe.

Take out the needle from the syringe, and put exactly 1 c.cm. of blood into each of the three tubes. Cork the tubes with rubber corks and allow them to stand in the water-bath. Wait for 3 minutes, and then every 15 seconds in rotation take a tube and tilt the contents to see if the blood has set. Continue doing this until the blood is found to have set, so that the tube can be inverted without spilling any blood; note the time.

Normal time limits = 3 to 6 minutes.

*Comment.*—The second method is more accurate, as certain disturbing factors, e.g., tissue juice, are eliminated.

## B. Bleeding time

### I. Duke's method

*Apparatus required*

- (i) Pricking needle or blood gun.
- (ii) Filter-paper.
- (iii) Stop watch.
- (iv) Sphygmomanometer.

Clean the ear lobe or the dorsal surface of a finger, first with alcohol and then with ether. (The tip of the finger is not suitable for this test as it is horny in many cases.) Prick the selected site fairly deeply with a blood gun or a pricking needle, so that blood flows freely without squeezing. Soak up the blood which comes out with a clean piece of filter-paper without touching the skin. The flow of the blood should be such that the first impression on the filter-paper has a diameter of about half an inch. Continue to soak up the blood with the filter-paper every 30 seconds until the bleeding stops.

The time from the first appearance of the blood until the cessation of bleeding is the bleeding time.

Normal limits = 1 to 3 minutes.

## II. Venous pressure method (Ivy et al., 1935)

Put the cuff of a sphygmomanometer around the arm above the elbow as is done in taking blood pressure. Select a portion of the forearm below the elbow and clean it with alcohol and ether. Raise the pressure and maintain it at 40 mm. of mercury, which is sufficient to check any venous return. Prick sharply up to a depth of about 1/10th inch, at a point free from any superficial veins, so that blood will flow freely. Soak up the drop of blood every 30 seconds, as in method I, until the bleeding stops.

This method is superior to method I, as the capillaries are kept wide open and their tone eliminated; also the area selected for puncture is uniformly thin. For these reasons more consistent results are obtained with this method than with method I.

Normal limits = 2 to 4 minutes.

## C. Quantitative determination of prothrombin in blood; prothrombin time

*Apparatus required*

- (i) Ten c.cm. record syringe.
- (ii) Centrifuge tubes.
- (iii) Small test-tubes in a rack.
- (iv) Water-bath with a thermometer.
- (v) Capillary pipettes with teats.
- (vi) Stop watch.

*Solutions required*

- (i) Sodium oxalate solution: dissolve 1.34 gramme of chemically-pure anhydrous sodium oxalate in 100 c.cm. of distilled water.
- (ii) Calcium chloride solution: dissolve 1.11 gramme of chemically-pure anhydrous calcium chloride in 100 c.cm. of distilled water. Check the strength of the solution by titration against silver nitrate solution.
- (iii) Thromboplastin solution.

### Preparation of thromboplastin solution

Satisfactory results will be obtained with either of the following substances:—

(a) From rabbit's brain: Dissolve 0.3 gramme of dehydrated\* rabbit's brain in 5 c.cm. of normal saline containing 0.1 c.cm. of sodium oxalate solution, incubate at 45°C. for 10 minutes and finally centrifuge at a low speed for 5 minutes. Pipette off the milky supernatant fluid and keep the solution in a cold incubator, floating a little toluene on the top of the solution. The solution will keep for about a month.

(b) From Russell's viper venom.

A 1 in 20,000 solution of Russell's viper venom gives a potent thromboplastic solution. In the dried state the venom maintains its full potency indefinitely; Mr. N. K. Iyengar informs us that, kept in a refrigerator with toluene, the solution also retains full potency for more than a month.

\*Dehydrating the brain: Remove all the blood vessels, and then macerate well in a glass mortar. Add acetone and macerate again. Decant off the acetone, add some fresh acetone, macerate, and again decant off the excess of acetone. Continue doing this until the whole thing is converted into granular powder; keep in a cold incubator. In the dried state its activity is retained for a long time.



*Technique.*—A slightly modified Quick's method is followed :—

Put 0.5 c.cm. of sodium oxalate solution into a centrifuge tube.

Collect blood in a dry syringe (*vide* part I) and put 4.5 c.cm. into the centrifuge tube containing oxalate solution; mix well.

Centrifuge until the plasma completely separates; carefully pipette off the supernatant plasma and put it into another dry sterilized tube. Put exactly 0.2 c.cm. of plasma into each of the three tubes marked A, B, and C.

Keep the water-bath ready at 37°C. Take three of the dry test-tubes and to each add exactly 0.2 c.cm. of thromboplastin solution and 0.2 c.cm. of calcium chloride solution.

Put one tube containing the plasma into the water-bath, and, when it is warm, to it add the mixture of thromboplastin solution and calcium chloride solution, from one tube; note the time when the mixture is added to the plasma; shake gently keeping the tubes in the water-bath, and again note the time when the clot first appears.

Repeat the experiments with the other two tubes. Take the means of the three headings; this gives the prothrombin time.

Normal = 15 to 25 seconds.

#### D. Hess' capillary resistance test

##### Apparatus required

- (i) Sphygmomanometer.
- (ii) Stethoscope.
- (iii) Hand lens.
- (iv) Skin marking pencil.

Place the cuff of a sphygmomanometer on the arm above the elbow as in taking the blood pressure.

Determine the systolic and diastolic pressures; release the pressure. With a skin (or glass) pencil mark any purpuric spots that may be present on the forearm.

Raise the pressure to a point midway between the systolic and the diastolic, and maintain it at this point for 5 minutes. Remove the armlet and examine the forearm in a strong light, and if necessary with a hand lens, for purpuric spots (other than those already marked). A positive result, indicating decreased capillary resistance, is shown by the presence of a number of small fresh purpuric spots distributed over the forearm below the point at which the armlet was applied.

The process should be repeated on the other arm.

#### E. Clot retraction study

When blood coagulates, a clot is formed which after a time contracts and expresses the serum; the clot itself then shrinks and becomes hard. Retraction of the clot, as it is called, varies directly with the number of platelets in the circulation, but is independent of the coagulation time; with a low platelet count, 60,000 per c.mm.

(Continued at foot of next column)

## WATER IN RELATION TO HEALTH\*

By RAO SAHIB T. N. S. RAGHAVACHARI

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PUBLIC health has been defined as the science and art of preventing disease, prolonging life and promoting physical health and efficiency

\*An address delivered before the Society of Biological Chemists, India, at the University Biochemical Laboratory, Madras, on 5th May, 1940.

(Continued from previous column)

or below, it takes over 24 hours for the clot to separate and the clot is soft and friable.

##### Apparatus required

- (i) Same as for collecting blood.
- (ii) Graduated 10 c.cm. centrifuge tubes, each fitted with a cork having a hole in the centre.
- (iii) Glass rods with flanges, about the size of a silver 4-anna piece half an inch from the end.
- (iv) Test-tube rack.

*Method of Macfarlane.*—Collect blood from the patient in a dry syringe (*vide* part I).

Put 5 c.cm. of blood into the centrifuge tube. Put in the cork with the glass rod passed through the hole in the centre of the cork. See that the flanged end of the rod is near the bottom of the centrifuge tube (figure 3).

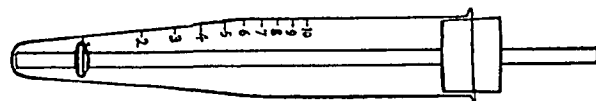


Fig. 3.—Showing centrifuge tube with glass rod in position.

Place the tube in an upright position in the rack and put the rack into an incubator at 37°C.

From one hour onwards, examine the tube from time to time for clotting.

After one hour of clotting, remove the clot by drawing out the glass rod (the clot will adhere to the flanged end of the rod).

Note the amount of fluid in the tube.

The amount of fluid in the tube divided by the amount of blood put in the tube and multiplied by 100 gives the percentage of retraction.

##### Example.—

Suppose 5 c.cm. of blood was taken and 3 c.cm. of fluid was left after the removal of the clot.

Retraction =  $\frac{3}{5} \times 100 = 60$  per cent.

Normal retraction = 48 to 64 per cent.

The clot is also examined for firmness and friability.

Clot retraction is low in thrombocytopenic purpura, but is normal in hæmophilia.

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through organized effort. Modern public health had its origin in England in the middle of the nineteenth century when sanitary conditions had become intolerable in cities as a result of industrial development. Public health first concerned itself with the improvement of the environment and was really, therefore, an art at that time, as the biologist, the chemist and the biochemist had not given to the world the scientific principles upon which modern public health is based. Municipal sanitation was the main theme of any public health programme. Although the germ theory of disease had not been established, it was recognized that an abundance of good water was necessary to promote health in urban areas, and it was also known that the spent water required to be transported to a safe distance in order to prevent unbearable conditions.

With the advent of the bacteriologist, in the latter half of the last century, preventive medicine became a prominent feature of environmental sanitation. To-day, the physiologist and the biochemist have given a fresh impetus to the movement of health conservation; and personal hygiene, collectively applied, forms part of a well-organized public-health programme. The provision of protected water supplies, of efficient sewage disposal, of suitable legal and other enactments for ensuring safe supplies of milk and foods and of various amenities that make for comfort and good health, looms large in the horizon of the modern public-health atmosphere.

Even in this country of ours, there has been of recent years an awakening to the necessity for and the beneficial effects that would accrue from a well-ordered control of water and milk supplies, sewerage, housing and nuisances, and the bulk of the activities of the public health and sanitary engineering departments in this province has centred round these problems. I must, however, say that we have but just entered the outermost fringe of modern public health as judged by western standards. The relationship of water to health is my theme for to-night and it sounds such an absurdly simple one that one may be tempted to ask what is the wonderfully new thing that I am going to tell you, which you do not know already. Let me at once say it is indeed a simple matter and at the same time, it consists of a variety of important and intricate facts, some of which, at any rate, would be interesting to many of you.

It is perhaps unnecessary for me to tell you that pure water does not exist in nature and that the common impurities exist either in solution—gases, minerals or salts, organic matter—or in suspension—silt, sand, clay, and living organisms as algæ and bacteria. Some of the impurities are of no consequence except when present in large amounts, while others are of such great and grave importance (these include the disease-producing bacteria) that they must be removed or kept out of the water by taking

all possible precautions. A *safe water* is one that will not cause disease or other injury to persons who drink it. A *potable water* is one that is suitable for domestic use and, therefore, safe to drink, in addition to being usable for cooking, washing, bathing and watering cattle. A *polluted water* contains organic matter or wastes to an extent which renders it unfit for domestic use. A *contaminated water* contains germs that would cause disease. The common water-borne diseases, as you know, are typhoid, dysentery—both bacillary and amœbic—and cholera. I do not propose to tell you about the mode of spread of these diseases through water. The presence of organic impurities in excess—derived from animal and vegetable sources—apart from the presence of incidental bacterial contamination, can, *per se*, account, at best, for vague gastric upsets, particularly in delicate individuals and in persons who are psychologically conscious. The presence of algæ in considerable amounts has been incriminated in the production of gastric disorders, *e.g.*, diarrhœas, and has also been considered to be deleterious to cattle in certain cases, where the water level of ponds had gone very low, resulting in a rich concentration of algal life. There has, however, been no authentic record of specific instances where this aspect of the problem has been proved on the basis of a mathematical equation. And I must frankly tell you that such convincing proofs are difficult to adduce in view of the many other factors that go to make up the story.

Now, these ubiquitous forms of life known as algæ occur in all surface waters and show seasonal variations in preponderance and productivity. They have been studied from various aspects by several eminent biologists all over the world. Dr. Mortimer of the Freshwater Biological Association at Wray Castle, in a recent contribution, laid great emphasis on the role of the 'nitrogen balance' in water and of phosphates in algal productivity.

The findings of western observers in respect of many problems are often accepted by us here, as though they were universally applicable under all conditions. No doubt, in many cases, their findings would have been based on laborious research extending over several years and covering a variety of conditions and materials. But, are they all, therefore, universally applicable to every country and every type of climate? The answer to this question can be furnished only by the same process which was responsible for the original findings, *viz*, research.

The mention of the word, *research*, is, sometimes, enough to scare many people and there have been several occasions when I have heard responsible civic administrators say, 'No more research on our water supply, please; there has been enough already of that sort of thing'. These well-meaning but ill-informed people think that research on a particular subject shall

be done once and for all and the findings reached are immutable for all time. Research is not something elusive and fantastic to be used only within the mystic atmosphere of a laboratory. It is an organized and diligent investigation to discover facts which may be applied with equal facility and assurance to the solution of any problem in any realm of human activity. It is a tangible, ever-ready tool, the wise use of which begets results whose value exceeds the expenditures in time, effort and money. To a large extent, research is an attitude of mind, that attitude which prompts one to be asking eternally the question *Why?* that attitude which does not permit the closing of the mind, that attitude which leads to ascertaining what people in other countries and in other walks of life are doing, and adapting only that which is adaptable to one's own work and rejecting what is not applicable, that attitude which warns against the folly of complacency and satisfaction with things as they are, that attitude which expresses itself pithily but eloquently in the short phrases, 'What is not yet, may be', and 'What may be, should be shown to be'.

Each phase of knowledge is connected by strings, often invisible, to a previous state of knowledge. This connection has to be explored, discovered and carefully examined for its suitability of application to the conditions obtaining in each locality. As instances I may mention :

(i) the behaviour and reactions of certain *coliform* bacteria found in the tropics, to certain tests which are considered specific in the temperate regions, have been shown, by carefully controlled research conducted by me at the King Institute, during the past three years, to be different to those recorded in England.

(ii) the classical work of the late Sir Alexander Houston of the London Metropolitan Water Board, on storage as a great safety factor in water purification, legislated for three months' storage of river and upland surface waters for ensuring perfect safety. Work carried out at the King Institute with a river water in 1930 showed that storage for more than 5 days was not helpful under tropical conditions, as there was a tendency to bacterial increase after the fifth day and a liability thenceforth to excessive algal growths.

(iii) Again, certain factors that are credited with the power to influence the productivity and predominance of algal forms in a profound manner in English reservoirs and lakes do not appear, from our recent researches (still in progress at the Institute) to be applicable to tropical conditions. Thus, the majority of waters impounded in our reservoirs contain no nitrates, nitrites or phosphates (which are considered by Dr. Mortimer and his colleagues at the Freshwater Biological Association at Wray Castle, to be of paramount importance in algal productivity). Still algal troubles constitute a

serious menace to filtration and chlorination processes in our province. Salem and Adoni have experienced very severe troubles from algæ for several years, resulting in inefficient filtration and chlorination, and in pronounced taste and odour troubles. Chidambaram and Cocanada have been recently having such troubles.

The organic impurities added to the water by the natural death and decay of algæ often impart a pronounced disagreeable taste and odour to the water. Filtration and chlorination become expensive and difficult. So, these have to be got rid of by suitable algicidal methods. A considerable amount of research work has been and is being done at the King Institute during the past two years, on the use and selective action of different algicides, such as copper sulphate, chlorine, ammonia, both alone and in combinations. When present in excess, algæ are liable to cause discomfort in susceptible and delicate stomachs, as I have already mentioned.

Not so with the inorganic constituents present in water. Since the consumption of water involves every human being, the majority of whom have had no scientific training, we find that public opinions relating to the physiological effects of the mineral salts present in natural waters have been moulded without any consideration of the logic of the conclusions. Many results which have been accepted as truth are found, on closer examination, to have come from uncontrolled experiments which cannot, by any stretch of the imagination, be classified as scientific research.

When Louis the XIV of France became ill with typhoid fever and when his fate was uncertain for some weeks, his physicians administered a dose of antimony as a desperate measure. Soon he improved and then rapidly recovered and his recovery was attributed to the effects of the antimony on the basis of Plutarch's arguments. They little realized that the king recovered *in spite of* the antimony and *not because of* it. The same type of logic exists even to-day. We often hear it said that the tank water at Tirukkalukundram, or a well water near far-off Virudhunagar has miraculous healing powers, and that the maladies of thousands of people vanished with the drinking of this or that water. It is agreed by health authorities that human beings, in general, do not normally drink enough water. Now, in this case of the wonderful cures, what really happens is, the people who resort to these 'spas' alter their entire mode of living, and during the treatment play, rest and drink far more than normal quantities of water, and live in entirely different environments. We are well aware that many maladies rapidly respond to rest, recreation, change of air, and that waste materials are flushed from the system by an increased consumption of water. Regardless of these facts, the mineral content of the water is often unjustly and incorrectly boosted up.

Again, we often hear of waters being condemned as unsuitable, unpalatable, disease-producing, and so on, owing to the concentration of one or more inorganic mineral salts. Only a very few inorganic substances, I may say, have been really proved by scientific data to affect the public health in the concentrations in which they are found in natural water supplies. Some may affect the odour, colour, taste and turbidity. But, nearly all of these are practically innocuous physiologically, even in concentrations sufficient to produce intense colour, turbidity, odour or taste. No doubt, odour and taste may affect some persons psychologically to the extent that they may develop and exhibit physiological reactions. There is obviously much difference between a pure water and a physiologically safe water. I have always felt that it would be easier to define safe water than pure water. I do not know if any one of you here can give me a correct definition of pure water. It certainly is not  $H_2O$  in the liquid phase.

For æsthetic reasons, a drinking water must be as free of taste, colour, smell, and turbidity as possible, even though the substances causing them are harmless, *per se*, and even though the æsthetic quality of a water may change considerably without much significant chemical change. In other words, a water chemist must necessarily be a good psychologist as well as a water-purification expert. Thus, for instance, keeping water purification plants and laboratories spotlessly clean and as free of odour as possible, providing the water works with beautiful parks and footpaths, insisting on cleanliness and smart appearance of the staff, encouraging visits from the consuming public, all these may not affect in the slightest degree the purity of the finished water as issued to the public, but will certainly go a very long way in creating good will, confidence, and a feeling of security in the public towards their water supply.

I have already mentioned the physiological effects of bacteria in water on health. The data on physiological tolerance to inorganic impurities in potable water, are very conflicting and would, therefore, to my mind, bear cataloguing, if only with a view to provoking thought among the scientific workers I have the privilege of addressing to-day. The problem is, no doubt, very difficult to investigate and reliable information, based on accurate laboratory experimental data, is woefully lacking in many cases. Much that is known concerning physiological effects of mineral salts has been based on the experiences of consumers actually using the waters, rather than by exact laboratory studies. Only very approximate and necessarily imperfect data can be so obtained since human beings are not physiologically identical and a plethora of individual idiosyncrasies always comes into the picture. Again, susceptibility varies with age, sex, climate, occupation, and so forth. Finally, the effects of small traces of many substances

on the body's chemistry are still puzzling, even to the specialists. Not a year passes, but one of the ninety-two elements is added to the list of those having an important physiological bearing on health, zinc and fluorine being the most recent. Further, the physiological effect of simple metallic ions would probably be different from that of complex ions containing the same element.

Hard waters have been blamed for various disorders such as urinary concretions, arteriosclerosis, dyspepsia, constipation, goitre, diarrhoea, rheumatism and what not? There are critics who are never tired of saying that, due to the excess of calcium and magnesium contents in drinking water, our alimentary canals are getting coated with scales, as if they were boiler tubes. Hard waters have, however, been exonerated by several investigators both by mortality statistics and by experimental research. Some European authorities have recorded that, in communities where hard water is used for drinking, better teeth, body-weight and nerves are produced. Where lime is added to water as a corrective, I think the civic authority is doing the public a favour, since the one element most lacking in our dietaries is calcium. The human body requires approximately 0.7 to 1.0 gramme of calcium per day. Calcium taken with water would supplement that consumed with food. Large amounts of calcium salts would certainly affect the palatability of water but that is again a matter of individual taste. As a general rule, except for very few of the metallic ions, the taste factor will prevent consumers and even animals from injuring themselves physiologically by drinking such waters.

Textbooks lay down that drinking water should contain no caustic alkalinity. There, however, would appear to have been no facts or scientific data which would substantiate possible deleterious effects resulting from the use of waters containing small amounts of caustic alkalinity. It has been found that as much as ten parts per hundred thousand of calcium hydroxide alkalinity would be required to produce a distinct alkaline effect and that the dividing line lay between five and ten parts per hundred thousand. Like the calcium ions, magnesium in public water supplies is really of no public health significance. It affects the taste more than calcium, and, if you find a water is palatable, you may be certain that you are ingesting too much of magnesium. It is now known that the human body requires about one-third gramme per day of magnesium for normal functioning.

Salts such as sodium chloride and sodium nitrate pass through the intestinal walls, are absorbed by the kidneys and eliminated in the urine. This produces thirst, and by quenching the thirst we flush the salts from the system. Potassium nitrate seems to be more effective in this respect and the necessary dosage is small enough to include some natural waters. Any

form of nitrogen in water indicates organic pollution, but, where nitrates alone are found, we say that the organic matter has been oxidised to the fullest extent and rendered harmless from the sanitary standpoint.

All metals dissolve in water. Copper has, within the past ten years, assumed a very important rôle as a necessary supplement to iron for hæmoglobin regeneration. It is an essential constituent of tissue cells. Prolonged heavy exposure to copper ions would, no doubt, damage the body. The traces left in potable water, as for instance after an algicidal treatment of the raw water in a lake, can certainly be in no way harmful to health. The body requires at least two milligrammes of copper a day and so 0.2 parts per million, which has been laid down as a permissible limit in water, is almost certainly therefore helpful, and not harmful. Chloramines in water supplies have not been proved to be physiologically objectionable. The suggestion made by the late Major Harold, Director of the Metropolitan Water Board of London in 1936, as to the continuous use of chlorine and ammonia along with copper in order to keep copper from precipitating out as copper carbonate and to secure a more sustained and prolonged algicidal action, has not met with disapproval, and does not therefore increase the copper hazard, so far as is known. The so-called cupri-chloramine treatment would mean, perhaps, very slightly more copper as distributed copper ions and copper bound in complex ions may have altogether different physiological effects.

Practically, everything in this world is poisonous and yet nothing is poisonous, if used correctly and in moderation. This applies to copper ions. I do hope that the time will come and soon come when public-health authorities would consider it to be advantageous biochemically to have traces of added copper in public water supplies. An American patent granted in September 1937 permits the incorporation of iron in milk. A number of biochemists and physiologists actually claim that the old-time method of cooking in copper and iron vessels was definitely of physiological importance as being beneficial to health. The use of copper vessels in Hindu households—now unfortunately going out of vogue in obedience to the dictates of fashion—had obviously, therefore, a hygienic and scientific basis. The lowest concentration of copper at which it can normally be tasted is reckoned at 1.5 milligrammes per litre.

*Aluminium* : The aluminium which gets into a purified water supply using alum for pre-treatment was believed, at one time, to be deleterious to health. It is no longer so; it has also now been definitely proved that food cooked in aluminium vessels is quite safe and fit for use. *Arsenic* is very seldom met with in water supplies. The amount getting into a supply from galvanized iron pipes is negligible. *Lead*

ions have had a bad reputation though some of it is not deserved. If the very small amount of lead which we ingest through water and food were as harmful as some people believe them to be, there will be many more cases of lead poisoning than are known to occur. No doubt, cases of plumbism have been reported in England, Germany, and France, traced directly to public soft water supplies. There is a widespread, but to my mind an erroneous, belief that lead accumulates steadily and is, therefore, a cumulative poison. This would mean that none of it is excreted. Some able chemists have published articles formulating conclusions on plumbism, supported by slender or no physiological evidence. Based largely upon these facts, 0.1 part per million of lead has been laid down as the permissible upper limit in water. Recent researches have, however, shown that the ingestion of lead ions in normal amounts does not result in a steady accumulation of lead in the body and that, apparently, an equilibrium is reached after a time, so that a substantially constant concentration of lead remains in the tissues, the daily lead output being equivalent to the daily lead intake.

*Iron* salts, both ferric and ferrous, are physiologically harmless to the system. The limit of 0.3 parts per million that has been prescribed in textbooks is based more on taste and colour considerations than for physiological reasons. Man requires 5 to 6 milligrammes of iron per day, and inorganic iron, as found in drinking water, can still be absorbed and utilized. The reason for keeping the iron content of potable waters low is an industrial, but certainly not a physiological, one.

A limit of 5 parts per million has been laid down for *zinc*. When the source of zinc contaminating the water, as commonly happens, is the galvanized iron pipe, the zinc compounds usually found in the water will be a mixture of oxide, hydroxide and carbonate, the last one perhaps predominating. Zinc carbonate, when present to the extent of 30 parts per million, would cause a noticeable milkiness in the water and would also give it an astringent taste. While there is no reason to consider this harmful, *per se*, you will realize that nobody will look at it, as a thirst-quencher. Foods and beverages, with the exception of simple or chlorinated drinking water, should not, however, be stored in zinc-lined or galvanized containers. And waters with a relatively high zinc ion content should not be used in making acid drinks, such as lemonade, as the resultant zinc citrate is a very poisonous substance.

*Selenium, Boron, Manganese, Radium, Silver and Barium* : These have all come in for comment and criticism in connection with drinking water supplies. Forage from seleniferous soils and drainage water from an irrigation ditch in Colorado, with a high selenium content, have

been stated to produce death among cattle. No authentic and scientific data have, however, yet been adduced, which would go to prove conclusively that selenium was the primary agent in the causation of these deaths. *Boron* ions are of great importance to plant life and even when present in concentrations high enough to affect plant growth, they are not likely to have any adverse physiological effect. This would appear also to be the considered opinion of the U. S. Department of Agriculture. *Manganese*, like iron, is usually removed from water for reasons which are not physiological. This element has, during recent years, come to be considered essential to normal bodily function. I have not come across any report in published literature of poisoning by *radium* from drinking waters. *Silver*, as most of you probably know, has been used in water sterilization during the past fifteen years and a process under the name of *Katadyn* has been patented by Krause of Germany. A consideration of the physiological effects of silver ions has consequently appeared on the canvas. I have often wondered, during the last ten or twelve years, ever since I had occasion to carry out some detailed research on the *Katadyn* sterilization process, if there was not a distinct possibility of the silver ions introduced into the water removing available iodine ions from water supplies, by precipitating the latter as the insoluble silver iodide. This would apply, *pari passu*, to *barium*, which occurs in appreciable amounts in the drinking waters of Switzerland. This might have some relation to the prevalence of endemic goitre in severe form in that country. A recent report in the *Journal of Endocrinology*, however, denies the existence of any relationship between the incidence of goitre and the silver and barium content of waters.

All the elements I have mentioned may, however, come into the picture in the future as fluorine has done, during the last few years in America and during the past three years in Madras.

Toxic qualities of fluoride in water used for drinking and cooking during the period of teeth calcification cause what is commonly known as mottled enamel, or specifically known as chronic dental fluorosis. This condition has been observed in approximately three hundred states of the United States of America. Sixteen of these states are west of the Mississippi river. Through investigations and research beginning in 1926, it is now established that the element fluorine combined as a fluoride, when present in a water supply in excess of about 1.0 part per million, affects the teeth of growing children, and thus a new problem in the water supply field has arisen. Ordinarily, fluoride in toxic concentrations is generally found only in underground water supplies and the problem is, therefore, in the main, confined to the smaller communities, although in certain areas relatively larger populous centres also are affected.

To most, if not to all, of you, the work that has been and is being done at the King Institute, during the last three years, on chronic endemic fluorosis must be familiar. The discovery in 1937, of a restricted area in north Nellore, where not only mottling of the enamel of the teeth in children, but also serious and disabling bone involvements in adults, were found to occur as a result of intoxication from fluoride present in drinking water, led to an intensive and extensive study of the various factors concerned in the production of such intoxication in that area. At the same time, a vigorous search was made for the presence of this element in samples of water received from all over the province, which resulted in the discovery of many more places scattered over the whole province, where the ground water supplies showed the presence of fluorides in sub-toxic and toxic amounts. The finding of fluorides in waters in our province has, indeed, been a disconcerting feature but has to be faced squarely. The removal of fluorides from water, when present in toxic amounts, has been engaging the attention of the King Institute and of several other agencies in other parts of the world. No satisfactory method of removal which would be at once economical and efficient has yet been evolved. To digress for a moment, some of you may probably know that wholesale iodisation of water supplies with sodium iodide was tried in a few cities of the United States in 1923 as a prophylactic measure against goitre, but it was soon abandoned in favour of direct treatment for those who suffered from iodine deficiency. The treatment of water supplies by the addition of moderate amounts of fluorides has similarly been suggested, during the past few months in America, as offering the most practical means for the prevention of dental caries in children. This is based on the results of certain observations made by some scientists who found that, in areas where mottled enamel was widely prevalent, the incidence of dental caries was very low.

Except for the protection of the teeth from dental caries, no other need for fluorine has ever been shown. Studies on fluorine have practically all been confined to fluorosis; the consequences of afluorosis, if any, are yet unknown. Sharpless and McCollum, the great nutrition experts, in the only published study of afluorosis, found no apparent injury to rats raised on low fluorine diets. Between mottled enamel and bone troubles from too much fluorine and dental caries from too little lies a field for much study by dietiticians, physiologists, biochemists and doctors, so as to discover just how the diet and drink intakes of the individual contribute to the making and maintenance of good tooth structure.

I have so far attempted to show that very few inorganic substances, in the concentrations found in public water supplies, have been found, by scientific evidence, to affect the public health. I will now pass on to a consideration of what



may be called the pharmacology of water, that is, the positive and beneficial results to be expected from the use of water. This would mean that I consider water as a medicinal agent. Yes, I do and for valid reasons. The human body contains nearly 80 per cent of its weight of water in one combination or another. Water is a remarkable solvent of gases and salts and a palatable drinking water always contains these substances. People from one locality rarely like the water in another. The salts present in water, though very small in amount, impart a distinguishable taste to which we get accustomed.

Water is most essential to health. It aids digestion, elimination and the automatic regulation of body temperature. It is remarkable how quickly a glass of cold, or even more rapidly a glass of warm water reaches the skin and by evaporation cools the body, by dilution of the blood aids circulation, by dilution of the food aids digestion, and by the dilution of the waste products aids its excretion and elimination. The dilution of the food does not, as formerly supposed, dilute the acid and pepsin in the stomach. It increases their secretion and doubly aids digestion. Large quantities of water may be taken with meals with no harmful effects, as the benefits resulting therefrom include the flow of digestive fluids, the hastening and increasing absorption of food, leaving less in the intestines for bacterial decomposition. Drinking water allays also the pain due to hunger contractions. Thirst for water is, indeed, a response to the concentration of salts in the tissues, a lessened flow of saliva and the drying up of the mucous membrane. The elimination by the kidneys and the skin must, therefore, be promptly restored.

Digestive enzymes are known to act only in a fluid medium and it is only the dissolved or suspended material that is readily absorbed. As you know, it is only the moist air that is passed through the lung tissue. Hydrolysis and the reverse are constant processes in metabolism by which the protein molecules are converted into simple assimilable amino-acids. Even such a simple substance as sugar requires the addition of a molecule of water to transform the disaccharide molecule into two monosaccharide molecules which are readily absorbed and utilized by the body. Few chemical or biological reactions can occur without water. Perfectly dry formaldehyde gas or sulphur dioxide would have no effect on dry bacteria, and absolute alcohol has been shown to be equally ineffective as a rapid bactericide. But, with moisture, each of them becomes a potent and quickly-acting germicide.

Waters containing gases, carbon dioxide or hydrogen sulphide in solution are often used for their medicinal effects. Carbonated water, natural or artificial, stimulates the stomach into increased activity by a mild irritation, thereby

increasing absorption and necessarily, therefore, elimination. It aids in expelling flatulence from the stomach and intestines. It is more palatable and sharper to the taste than ordinary water, and is therefore often used in fevers or where extra elimination is required.

I believe I made a passing reference to reputed cures from the use of certain tank and well waters. The real thermal springs contain a small proportion of  $H_2S$  and alkaline sulphides, and are consequently recommended for respiratory and skin diseases, syphilis, gout, rheumatism, and even metallic poisoning. It is, indeed, more than probable that all the benefits derived from such waters are due to the heat of the water and to the prolonged and frequent baths ordered by a physician, rather than to any specific effect of the sulphur. The gaseous content, which, when it emanates from a sewer, is considered obnoxious, is here indirectly a benefit, as it aids the mind to respond to the action of the water containing it.

If we pause to consider the minute amounts of the substances contained in water and attempt to assess the effects on the system of ingesting them, only a fertile and vivid imagination or a supreme faith in the principles of homeopathy, as exemplified by its fractional dosages, will recognize any value in those substances.

To all intents and purposes a good and safe water for drinking requires only bacteriological purification except in cases where some absorbable poison is present. Most forms of purification, therefore, aim at a reduction, if not elimination, of the bacterial content. As regards very hard waters, however, they are considered objectionable as cleansing agents, on account of their being wasteful of soap. The soap destroyed by hard water is nearly ten times the weight of the constituents responsible for the destruction

Palatability and cooking properties would be very good guides in the choice of a good drinking water supply for any community. People would automatically reject as unfit, a water which has a very high solid content, which is brackish or unduly alkaline, which does not boil dāl or which produces a discoloration of rice cooked in it. If, however, there is no other and better water available in any locality, they will take their choice with Hobson. Human instinct is seldom found to have failed in the assay of potability of water from the chemical point of view.

I may conclude, therefore, that any adventitious circumstance, under which water is used, or any peculiar property, real or imaginary, which will encourage a more liberal use of water, either internally or externally, is not to be underrated in its bearing on health. The presence of pathogenic organisms responsible for water-borne epidemics would constitute almost the only important factor to reckon with in the use of God's greatest gift to man, namely *water*.

## LECTURE ON CO-ORDINATED EFFORT IN HYGIENE\*

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THE health of a nation depends on the health of the individuals composing that nation. The object of hygiene or preventive medicine is to build up the health of the nation by the care of the health of the individual. The working capital of the individual is his capacity to pull his weight in the ship of state. Once that capacity has been impaired, instead of being an asset to the state he rapidly becomes a liability. Anything therefore which tends to render the individual fitter for the function he serves in life, or, on the other hand, anything which may impair that function, is of vital interest to the student of hygiene.

It is manifestly absurd therefore to suppose that hygiene is a subject restricted to the collection of vital statistics, to sanitation and conservancy, and to the control of infectious diseases, because hygiene must necessarily be concerned with every circumstance affecting the individual. Indeed hygiene aims at the protection of the individual from *all* disease, not only by attention to his environmental and personal hygiene, but also by raising his powers of resistance to disease.

Sir George Newman has said '... we have come to realize that our first line of resistance to disease is the health of the individual. Thus, although environment, infection and the accidents of life and disease undoubtedly exercise their influence upon him, directly or indirectly, it is the care of his own body, with its growth and development, its resistant soil and its natural powers of defence against disease which form the basis of good health and of scientific prevention'.

In the practical application of these principles, mere perfection in the environmental sphere would result in little advantage if the circumstances attending the birth, the home, the personal habits, the occupation, recreation and happiness of the individual were to be ignored. Provision must therefore be made for his care to be undertaken at the earliest moment in his existence; in other words, through care of the expectant mother. His birth must be conducted under the most favourable conditions possible; his after-care and that of his mother must be supervised by skilled workers, and, later on, arrangements have to be made for his care before his going to school, during school life and, later on still, when he is at work.

The successful fulfilment of this policy demands the closest co-operation, not only between preventive and curative medicine but

also with the authorities concerned with education, with agriculture, with the care of cattle, and with the means devised for the amelioration of the economic status of the people. These beneficent services must work as a team towards what must be their common ideal, namely, the betterment of the people. It is no good, for instance, for the Agricultural Department to recommend a method of manure conservation or storage if this happens to encourage the breeding of flies. The boon of an enriched soil and the prospect of better harvests would be nullified by the certainty of an increase in the diseases which are spread by flies. Similarly, as has often happened in the past, the benefits conferred on a people by the construction of new roads have been destroyed by the creation of many large breeding places for mosquitoes in the excavations made for the building of the road. Effective co-operation between the health and engineering services would prevent such a calamity.

This consciousness of the existence of other beneficent services and knowledge of the manner in which they can assist in the common cause is an essential requirement in any health or other social worker. Without it, no one can ever expect to see the fruits of his or her labours. Thus, for instance, it often happens that even within one department, a worker limits his sphere of activities so strictly to his own speciality that he literally ignores factors which his training teaches him to recognize as injurious. A lady health visitor, for example, who enters a house on her home visits tends the mother and the child, and then walks out having completely ignored clouds of flies, or myriads of mosquitoes or badly ventilated rooms, or bad drainage is really guilty of gross dereliction of duty. It does not matter whether she herself is capable of applying the remedy, or whether it be a matter which should be referred to another authority, she is still responsible for taking appropriate action to remove an influence which is detrimental to the health of the individual. Indeed the interest of the health visitor should go far beyond the immediate confines of health matters. She should take an intelligent interest in the economic condition of the family she is looking after, and she should be in a position to advise the housekeeper on village or other industries by which the family income could be augmented, so as to make it possible for a shortage in essential foodstuffs or adequate clothing to be remedied. She should be aware of such serious calamities as bad or poor harvests, or of ailments among the cattle, and she should not only suit her advice to the capabilities of the people, but should also see that appropriate help is forthcoming, if necessary, from the department concerned; either in the form of *taccavi* or loans from Government, or in the form of fodder, or whatever measures of relief Government provides. It is these opportunities of intimate contact with the family in

\* A lecture delivered at the Lady Irwin College, New Delhi.



the home that gives the trained lady health visitor the proud and important place she occupies in the practical betterment and education of the people.

Among the many pitfalls which beset the path of the social worker intent on the amelioration of the people, nothing is more certain to lead to failure than the giving of advice which cannot be acted upon. For instance, it is common knowledge that one of the most serious deficiencies in the average Indian dietary is vitamin A. Now the most effective remedy for this shortage is the encouragement of vegetable cultivation. Green leafy vegetables as you all know contain a very good proportion of this essential commodity and therefore all that is necessary, one would think, is to advise intense vegetable cultivation. But it is useless to do this if the people concerned are ignorant of the manner in which vegetables should be grown. In this case reference to the agricultural authority will enlist the assistance of that department in providing information and instruction in the subject.

The inculcation of sound practical hygienic principles and the correction of bad habits at a tender, and therefore more receptive, age involves the assistance and co-operation of the educational authorities; the improvement of communications so as to enable health workers to get to the people they are looking after, or to allow villagers access to welfare centres or hospitals, demands the help of the engineering services; improvement in the output of milk, both for nutritional as well as for economical reasons, necessitates the active help of the veterinary department; the dissemination of knowledge on all matters affecting the welfare of the people demands the assistance of the press and the radio; the correction of wasteful customs and the encouragement of thrift calls for the aim of the co-operative services with their banks and their thrift societies; the uneconomical division of landed property demands expert treatment by the consolidation authorities; while early notification of the outbreak of infectious disease demands the co-ordinated effort of the public, the medical practitioners and the police authorities. What therefore is wanted is a standing committee or board of all heads of departments which is known as the Central Officers' Board whose function it is to co-ordinate the efforts of each department.

No health worker can afford to do without the assistance of the revenue department which has so much influence in the *dehat*. I am not suggesting that compulsion should be brought to bear. Pressure, let alone compulsion, is foreign to Government policy and the success of welfare plans depends entirely on the willing co-operation of the people. Ultimately that can only be achieved by the spread of education, but in the meantime the active interest of the revenue officials in the schemes put forward will do much

to encourage the villagers to take them up. Another way in which the department can help is by prevailing on *lambardars* and other village notabilities to set a good example by adopting the recommendations made by the health or other authority for the improvement of the welfare of the villagers. It is no good inducing the *chamars* and *bangis* to take up house improvements, while the homes of the *jats* are left in their original state of filth and insanitation. Not only do their houses and their habits generally need improving just as much as those of the lower classes, but the fact of their taking them up naturally encourages the rest of the village to do so. *Lambardars*, *jagirdars*, *sufedposhes*, and retired government and army officials living in comfort and ease on their pensions owe at least this much to the state that they should give a lead to the villagers in adopting the measures directed to their improvement.

Of all the arguments which may be used in the persuasion of the people, none is more convincing than the force of example. There is therefore nothing more discouraging than to see a health worker who is slovenly or even grubbily dressed, or one whose house is ill-kept, ill-ventilated or full of flies and smoke, or whose children are smothered in dirt or have streaming eyes or noses. Similarly no school teacher can hope to carry any conviction in teaching personal hygiene if his or her own appearance leaves much to be desired. It should be axiomatic that every social worker should practice what he preaches and take a personal pride in the principles he practises. This carries conviction, breeds respect and raises the dignity—the *izzat*—of those who follow these practices. If more persuasion were needed, this is provided by the health and sturdiness of the children of those who take the trouble to learn, and by the comparative freedom of the family from the ailments which assail the average villager's family. Once the desire is created in the individual to live in a manner calculated to promote good health the battle is won. Social workers, and particularly public health workers, must remember that they are the instruments through whom this much needed education can be spread in the present circumstances, and that however difficult or humble their task, they are playing an important part in building up the nation's health, and with it, its self-respect.

There is much that needs to be done in India but the magnitude of the task should not deter any sincere worker. No estimate has ever been made of the financial loss debitable to ill-health in India, but when it is realized that in Britain the total economic burden of ill-health due to loss of work is estimated at something of the order of £300,000,000 a year some idea may be gained from this of the astronomical figure which must apply to India. Nevertheless, of the complex array of health services which have been built up in Britain, and which now cost

the nation some £113,000,000 per annum, none had more than a vestigial existence 70 years ago. With education, good-will and team work, there is no reason why the same measure of success should not be attained in India as has been achieved in Great Britain during the last generation which has changed a 41 per cent

C 3 nation into one which is over 80 per cent A 1.

The country must learn to pay more for the privilege of good health. In Britain the health services provided cost some £2-10-0 per head, or Rs. 33. In Delhi Province we only spend Rs. 3-8-0 per head.

## Medical News

### A. R. P. WORK IN INDIA

HANDBOOK ISSUED BY GOVERNMENT

THE Home Department of the Government of India have issued a handbook, the first of a series on A. R. P. in India, giving a broad outline of the principles which may be followed in regard to A. R. P. throughout India.

The object of air attack is to dislocate the war effort of a nation. To attain this, an enemy will deliberately attack targets of military importance and may also indulge in indiscriminate bombing of the civil population. The primary responsibility for active defence to resist an enemy lies with the defence services, but it is essential to have available a nation-wide organization to minimize the effects of air raids which may penetrate the active defences. Hence the necessity for air raid precautions.

The most effective weapon used by modern air forces is the high explosive bomb which may weigh from 25 to 3,000 lb. Damage is mainly caused by the blast of the explosion and by the fragmentation of the shell of the bomb.

The small incendiary bomb will normally pierce the ordinary type of roof and ignite the top storey. It is therefore essential to clear all upper floors of inflammable material. But reinforced concrete six inches thick will resist incendiary bombs of 2 lb. weight.

The control centre is the nerve centre of the local A. R. P. organization. It will receive reports of air damage from wardens and police and will issue the necessary directions to the various services, so that they can be despatched to the scene of the occurrence. All messages that come in either by hand or telephone will be recorded and the position of all air raid damage shown on a large area map by the insertion of differently coloured flags.

The primary responsibility for resisting the enemy's efforts lies with the active defence services. In order to ensure close co-operation between those services and the A. R. P. organization, it is imperative that where cities and cantonments are adjacent to each other, the service passive air defence and civil air raid precautions schemes should be co-ordinated with particular reference to the warning system and lighting restrictions. Local military and naval authorities will be glad to render assistance in the carrying out of practices and observations of their effectiveness.

Drastic lighting restrictions are an important feature of the precautionary measures to be taken as a form of security against air attack. The aim is to secure that, as far as practicable, hostile aircraft passing over the country at night would see no lights which might serve to guide them to a particular objective or assist them to determine their position. The restrictions therefore impose as a permanent condition general darkening in the cities classed as vulnerable and there is an obligation on those controlling lights, i.e., the police and air raid wardens, to observe and enforce the restrictions.

From the outbreak of the war all illuminated advertisements will be prohibited in vulnerable areas and all external lights will have to be shaded or extinguished according to local rules. In the case of internal lights complete invisibility from outside can be secured by the darkening of windows, skylights or

glazed doors. This can be done by fitting of blinds, covering the whole window with opaque paint, loosely fitted shutters of plywood in windows and automatic steel shuttering. In factories, it may be practicable to carry on work with lamps of lower power or so shaded as to throw light on the machine or bench.

The handbook also deals with air raid wardens, fire fighting and medical arrangements, rescue parties, maintenance of vital services, anti-gas protection and decontamination and training of A. R. P. personnel.

### ALL-INDIA OPHTHALMOLOGICAL SOCIETY\*

SEVENTH CONFERENCE AT BANGALORE

THE Seventh Conference of the All-India Ophthalmological Society was held at the Mysore Medical Association Hall, Bangalore, on Friday, Saturday and Sunday, 20th, 21st and 22nd December, 1940.

The conference was formally opened in the town hall by Sir Mirza Ismail, K.C.I.E., Dewan of Mysore, who conveyed a message of cordial welcome from His Highness the Maharajah of Mysore to the delegates to the conference.

The chairman of the reception committee, Dr. B. K. Narayana Rao, in welcoming the delegates once again to Bangalore referred to the anomalous position of the standards of vision in public services in the different provinces of India and drew attention to the problems of eye diseases due to nutritional defects and to injuries due to the rapid industrialization of the country.

In his address, the President, Dr. R. P. Ratnakar of Bombay, dealt with some of the ophthalmic problems engaging the attention of the profession and offered some suggestions to meet the difficulties.

The scientific session commenced with a collection of papers on trachoma in which the treatment of the disease received the greatest attention, the consensus of opinion favouring the use of sulphanilamide orally, silver salts locally and tarsectomy in advanced stages of the disease.

Dr. Bhaduri (Calcutta), who opened the discussion with a paper on trachoma in Bengal, referred to the low incidence of trachoma in Bengal, especially amongst the indigenous population, and described a few cases of acute onset with bacteriologically negative conjunctiva. He further drew attention to the persistence of active pannus or its recurrence in some cases with complete fibrosis of the conjunctiva.

Dr. Sathaye (Poona) referred to his experience of the disease in the Bombay Presidency and mainly dealt with the treatment of the disease. He also read a paper on surgical treatment of the disease by Capt. Gokhale (Poona), in which the author strongly advocated tarsectomy in advanced cases.

Dr. Shroff (Bombay) found silver iodide very efficient in curing trachoma in the first two stages and advocated tarsectomy for advanced cases.

A paper by Dr. Mitton (Delhi) on the administration of sulphanilamide in trachoma referred to her experience in a large number of cases with encouraging results. She had followed the dosage and period of treatment adopted by Dr. H. Gradle of Chicago.

\* Received for publication on 17th February.

Dr. Krishna Rao (Bangalore) spoke about the sulphanilamide treatment of trachoma as followed in the Minto Ophthalmic Hospital, Bangalore. He concluded that the results so far found were favourable.

Several members took part in the discussion on these papers.

On the 21st, after an interesting series of visits to various factories in Bangalore in the morning, a crowded programme of papers was got through in the afternoon. For want of time, some papers of members who were not present were taken as read. Two of these papers referred to two interesting cases of Boeck's sarcoidosis. As no materials were available in these cases for confirmatory evidence on histological grounds, the diagnosis rested mainly on clinical examination.

The papers read at this session included the following:—

1. Epithelial plaques of the conjunctiva by Dr. M. Ponnambalam and Dr. K. S. George.
2. Bloody tears—case report by Dr. M. Ponnambalam and Dr. K. S. George.
3. Membranous conjunctivitis in vaccinia—case report by Dr. B. N. Bhaduri.
4. Dyscoria—case report by Dr. M. Ponnambalam and Dr. M. B. Sundar Rao.
5. Relative and Arneith-Bonsdorff counts in hypopyon ulcers by Dr. K. Sundaresan.
6. Boeck's sarcoidosis by Dr. E. V. Srinivasan.
7. Surgical diathermy for the relief of increased tension in blind glaucomatous eyes by Dr. B. P. Nanavati.
8. What looks like a case of Boeck's iritis by Dr. K. Sundaresan.
9. A case of organized hæmorrhage of the Cloquet's canal in one eye with remains of persistent hyaloid artery in the other by Dr. M. S. Mehkri.
10. A case of dermoid cyst in the inferior medial angle of the orbit by Dr. M. S. Mehkri.
11. Case report of exudative retinitis with detachment of the retina by Dr. M. P. Krishna Rao.
12. A case of papilloedema by Dr. M. P. Krishna Rao.
13. Dermoid of the cornea—case report by Dr. B. N. Bhaduri.

On the last day of the conference an all day outing was arranged to the Bangalore waterworks at Thippa Gundana Halli, about 20 miles outside Bangalore.

The general meeting of the society was held at this place during the lunch hour. Three papers were also read during this time. These were a paper on 'Blindness in India' by Lieut.-Colonel E. O'G. Kirwan, I.M.S., which was read by Dr. Bhaduri, one on 'Factors that disturb the natural immunity and eye diseases' by Dr. C. N. Shroff, and one on 'An easy method of dealing with secondary glaucoma due to morgagnian cataract' by Dr. E. V. Srinivasan.

Dr. G. Zachariah mentioned the necessity for a uniformity in standards of vision for the various services throughout India and suggested the appointment of a committee to go into the question. A sub-committee was accordingly appointed.

At the general meeting, new office-bearers were elected for the following year:—

President.	Dr. R. P. Ratnakar.
Vice-Presidents.	Lieut.-Colonel E. O'G. Kirwan, I.M.S. (President Elect).
	Dr. E. V. Srinivasan.
Secretaries.	Dr. G. Zachariah. Dr. B. N. Bhaduri.
Treasurers.	Dr. K. N. Karanjia. Dr. C. N. Shroff.

It was decided that the Adenwalla medal will, in future, be awarded to the best essay written by any medical man in India on a subject to be notified hereafter by the committee.

It was also decided that a quarterly ophthalmic journal will be published by the society. Dr. B. P.

Nanavati and Dr. S. N. Cooper were selected to be the joint editors of the journal.

## FIGHTING DISEASE ON THE FRONTIER

OVER 500,000 out-door patients were treated in civil hospitals on the North-West Frontier border in 1939-40, showing an increase of over 40,000 as compared with the previous year.

In the Khyber Agency the building of a new hospital at Landi Kotal has been sanctioned. Forty thousand out-patients and 200 in-patients were treated in the existing dispensary. At the Jamrud dispensary the figures were 25,000 and 200 respectively.

In the Kurram Agency there are hospitals at Parachinar, Alizai and Sadda. The latter attracts tribesmen from Tirah as well as inhabitants of the valley. These hospitals between them treated 140,000 out-door cases and 1,100 in-door.

In the Malakand Agency there is a hospital at Malakand, a Swat State Hospital at Saidu, and dispensaries at Chakdara, Thana, Dargai and Loe Agra. Three thousand male and 1,000 female in-patients, and 11,000 male and 5,000 female out-patients came for treatment. In the Chitral State there are Government hospitals at Chitral and Drosch. Eighteen thousand out-patients and 300 in-patients were treated. The reluctance of the Chitralis to face surgical treatment is being overcome by the patient efforts of the medical staff, whose extensive touring was much appreciated by the villagers. Goitre is widespread, and diseases due to a poor diet are common.

The small civil dispensary at Fort Lockhart in the Kohat district provides treatment for tribesmen from both sides of the Samana hills, and the hospital at Gurguri for Wazirs and Khattaks. Thal is the rendezvous of large numbers of people from the settled districts, the tribal areas, and Afghanistan, and the existing private dispensary, which receives a Government subsidy, is to be replaced by a public one.

In the Dera Ismail Khan tribal area, the hospital at Jandola attracts many Bhitanni and Mahsuds tribesmen, rather over 9,000 out-patients being treated there. A scheme to electrify the building is under consideration, and this year four small and badly ventilated rooms were converted into two large wards. Although there is no provision for the segregation of the sexes, the proportion of women to men treated was as much as one to three. The Frontier Constabulary hospital at Drazinda, which is placed at the disposal of the Sherani tribesmen, treated 30,000 cases.

## WOMEN'S HOSPITAL

At Tank the women's hospital of the Church Missionary Society, managed by three European ladies, is visited by large numbers of Wazir and Mahsud women from Waziristan, as well as Bhitannis and other clans. This medical missionary work has aroused no protest from the Mohammedan tribesmen, indeed the respect which they all have for the devoted work being done was shown during the Shabi Khel Mahsuds' conflict with Government, when the chief leader of the opposition sent a message to the lady doctors saying that he had given strict orders to his followers that in no circumstances were they to be molested.

In the Hazara district the hospital at the constabulary fort of Oghi was patronized by tribesmen from the Black Mountain and the Indus Valley region, amongst them being 15 men who had received wounds in local warfare.

The Miranshah hospital in North Waziristan enjoys a high reputation among all tribes of the Agency particularly for the cure of gun-shot fractures, a common injury where most disputes are settled with firearms. The modern closed treatment of such wounds has achieved considerable success, the foul smell normally regarded as the drawback of this treatment being apparently less obnoxious to the tribal nose than one would expect. Successes have also been achieved in

the treatment of cataract and trachoma. Unsettled conditions have made it difficult for the medical officers to visit villagers; when they have done so the entire population has turned out for inspection. The Wazir, who believes that a handsome face attracts a fair lady, is beginning to realize the value of vaccination to prevent smallpox.

In South Waziristan there are hospitals at Razmak, Wana, Ladha, Sarwekai, Sararogha and Tiarza, and dispensaries at Kotkai, Chagmalai, Splitoi and Tanai. The tribesmen took full advantage of these facilities, but disturbed conditions prevented doctors visiting villages at a distance from the roads, though roadside clinics were carried on as far as possible.

## INDIAN DRUGS FOR EXPORT

### WAR STIMULUS TO INDUSTRY

THE following drugs are being produced in India in sufficient quantities for export, according to the Director-General, Indian Medical Service:

Alcohol, alumen, belladonna, carbonei dioxidum, chirata, digitalis, ferri sulphas, gum indic, hyoseyamus, Jalapa, kaolinum, lobelia, nux vomica B.P., oil vegetable hardened, oleum arachis, oleum eucalypti, oleum hydnocarp, oleum morrhuae (substitute from shark liver oil), oleum ricini, oleum terebinthinæ, opium and crude morphine salts, podophylli resina, rheum (rhubarb), santonium, scilla, sennæ folium, B.P., strychnina hydrochloridum.

## Current Topics

### Oral and Medical Treatment of Gonorrhœa in the Male

By P. S. PELOUZE, M.D.

(Abstracted from the *Journal of American Medical Association*, Vol. CXIV, 11th May, 1940, p. 1878)

FOLLOWING the introduction of sulphanilamide a number of other sulphonamide derivatives have been produced, some of which have shown as much curative value as has sulphanilamide itself. One, sulphapyridine, has been spoken of even more glowingly and there is accumulating evidence to suggest that it is somewhere between 25 and 50 per cent more efficient than sulphanilamide. Its cost, however, is such that it is far beyond the financial reach of dispensary patients. To date, only sulphanilamide and sulphapyridine are on the market. It is earnestly to be hoped that a way may be found to reduce the price so that both the poor and the near poor may share the benefits.

At least two of the other sulphonamides now being experimentally used for gonorrhœa have shown an unfortunate tendency to produce peripheral neuritis.

Because of the unfortunate limitations to the general use of sulphapyridine it might be just as well to consider sulphanilamide rather fully, realizing that what is true of it from the standpoint of toxicity and other features, aside from the obtainable percentage of cures, apply equally to the former drug in equal doses. It, however, should be stated that sulphapyridine rarely is given in larger doses than 4 gm. in the twenty-four hours. And no dissertation on any sulphonamide derivative used so far would be complete without the warning that these preparations bear toxic possibilities.

Beyond a doubt, much of the toxic picture could be obliterated if sulphanilamide medication was stopped just so soon as it obviously was failing to produce cure. Practically all the favourably influenced males are symptom free by the end of the fifth day. If such a change has not occurred in that length of time it is extremely rare for further administration to be of benefit. In other words, it is perfectly safe to consider the patient who is not almost entirely free from symptoms then as a sulphanilamide failure and stop the drug.

Later courses of sulphanilamide almost never have a controlling effect in the same case, but it has been shown that sulphapyridine used for those patients who have obtained no curative effect from sulphanilamide not uncommonly exercise a favourable response.

There are many schemes of dosage for sulphanilamide in this disease, most of which have been aimed at a prompt high concentration of blood which later can be maintained on a reduced dosage. That blood concentration is not the sole consideration is shown by the experiences of Van Slyke, Thayer and Mahoney, who numbered some of their successes among cases showing the lowest blood concentrations and some of their failures among those in which the concentration was enormous.

Perhaps the most common scheme of dosage in use in ambulant patients is 80 grains a day for two days, 60 grains a day for the next three days and a later continued daily dosage of 40 grains. Many clinicians consider this too high and use 60 grains a day for three of four days and a maintenance dose of 40 grains a day thereafter. Others claim successes in equal measure on 45 grains a day for eight days and a maintenance dose of 20 grains a day thereafter. In bed patients, on whom the most dependable figures have been obtained, the initial dose was 120 grains a day for several days and then a gradual reduction of the dosage. To such patients the drug has been given in doses so spaced as to prevent low blood concentration during the night. Some have given larger doses at bedtime to ambulant patients for the same purpose. Many administer sodium bicarbonate in half the quantity with each dose.

Sulphanilamide should be discontinued if it produces any marked symptoms of toxic action, and it never should be given to patients who cannot be seen by the physician at most every forty-eight hours. Because of its possible production of dizziness, it should be given with extreme caution or not at all to men in hazardous occupations.

From the foregoing it will be seen that much of the problem remains exactly as it was before the introduction of sulphanilamide. There is the same need for an understanding of the disease itself and those methods of treatment which have stood the test of time. By a sensible combination of the two one has no need for depression or the development of a defeatist attitude. In fact, the physician is standing on far better ground than he did a short time ago, for it has been shown beyond any doubt that, even in those cases in which sulphanilamide does not bring about cure, its use early in the disease almost invariably makes it a milder disease thereafter and enormously reduces the likelihood of serious complications.

There are a number of facts that one should have constantly in mind regarding gonorrhœa. These might be stated briefly as follows:

1. Gonorrhœa is a disease of tissue penetration by the gonococcus wherein the germs reach tissue depths far out of the bactericidal powers of the drugs applied locally.
2. Cure is brought about by the patient's own tissue processes.
3. These can be enhanced by the direct application of mild chemical solutions to the infected regions and the promotion of better drainage.
4. Certain factors greatly reduce or obliterate these tissue responses, namely the ingestion of alcoholic beverages, sexual excitement, prolonged physical exertion and the inhalation of the fumes of alcohol, ether and perhaps some other substances.
5. Thus the one 'priceless ingredient' of all curative effort is patient co-operation to the end that these circumstances do not occur.

6. The greater the patient co-operation and the gentler the treatment (within limits), the milder and shorter is the disease and the fewer are its complications.

7. Treatment of this disease is entirely empirical in that we have not the slightest knowledge of just how it accomplishes its purpose.

8. Traumatic methods have no place in treatment; they prolong disease and precipitate complications.

9. Aside from sulphanilamide and its companion drugs, oral medication has been signally lacking in curative influences.

10. Some drugs, notably oil of santal, at times reduce discharge and discomfort, though they exercise no definite curative effect.

Many drugs have been employed for the local treatment of gonorrhoea, but year after year these gradually have been reduced in number until to-day we find but a few that are in general use. Countless numbers of these have fallen into disuse because of the extravagant claims that their introducers made for them or the fact that many of them bore proprietary names and differed so little from pharmacopoeial drugs that their higher cost was not merited. I need fear no successful contradiction if I make the statement that none of the proprietary preparations of silver are of more value in the local treatment of this disease than are those in the pharmacopoeia. Of the drugs most commonly used for local treatment to the mucous membranes of the urinary tract, together with their most appropriate strengths, might be mentioned those in the accompanying table.

There are times when it is wise to use oral sedatives either for the prevention of penile erections or for the relief of pain and vesical discomfort. For the former, sodium bromide in doses of from 10 to 15 grains (0.6 to 1 gm.) at night is rather commonly used. For sensory disturbances some form of opium is to be preferred. Of these, camphorated tincture of opium in drachm (4 c.c.) doses or tincture of hyoscyamus in from 15 to 20 minim (1 to 1.3 c.c.) doses usually suffice for the milder symptoms. For the more severe, codeine in from one-fourth to one-half grain (0.016 to 0.032 gm.) doses, morphine in from one-eighth to one-fourth grain (0.008 to 0.016 gm.) doses or rectal suppositories containing one-fourth grain of belladonna and 1 grain (0.065 gm.) of powdered opium may be required. Some urge the value of mild alkalis and more generally use either potassium acetate or citrate in doses of from 10 to 20 grains (0.65 to 1.3 gm.).

*Drugs most commonly used for local treatment of gonorrhoea*

	Strengths	Best
Potassium permanganate.	1 : 10,000 to 1 : 3,000	1 : 8,000
Mild protein silver ..	3 to 10 per cent	5 per cent
Strong protein silver	0.25 to 1 per cent	0.5 per cent
Acriflavine ..	1 : 5,000 to 1 : 1,000	1 : 3,000
Silver nitrate ..	1 : 10,000 to 1 : 1,000	1 : 5,000

Regarding the use of chemicals to the urethra and bladder by means of injections or irrigations by hand, there are a number of facts that should be borne in mind, the most important of which are as follows:

1. One or two applications in twenty-four hours usually is of greater benefit than a larger number.

2. All applications cause a purulent response from the anterior urethra and if their response lasts more than an hour or two the chemical is too strong for the given urethra and its strength should be reduced.

3. All chemicals used over too long a period have a tendency to keep up the urethral discharge.

4. The appearance of many epithelial cells in the urethral discharge is positive evidence that the medication is too strong or has been used for too long a time.

5. Fluids should not be injected into the posterior urethra if only the anterior portion is infected.

6. If fluids are to be held in the anterior urethra without being forced into the posterior urethra, the quantity injected should not exceed 6 c.c.

7. If fluids are to be injected into the posterior urethra, it should be done either by low hydrostatic pressure or with the utmost gentleness by means of a bulb syringe with a blunt nozzle.

8. No instruments of any kind should be passed into the canal while the gonococcus is present.

9. Sudden marked changes for the worse in the patient's condition almost invariably denote poor co-operation.

10. The two glass test, properly interpreted, is the simplest way of following the course of the disease.

11. The amount of clouding of the voided urine is a safe index of the activity of the infection.

12. Even in the most favourable of the sulphonamide cases the urine becomes clear before the disease is cured. Hence a clear urine is by no means an evidence that the gonococcus has been eradicated.

As an appropriate scheme of treatment for this disease it is felt that a sulphonamide derivative in one of the suggested dosages might be given for the first five days. If at the end of this time the patient has no urethral discharge and has a clear urine, a maintenance dose of the drug should be continued for ten days longer, in the absence of toxic symptoms. If the local symptoms do not abate or if the drug must be stopped, the accompanying plan should be followed.

#### PLAN OF TREATMENT

*Anterior urethritis.*—1. After urination the anterior urethra is cleansed with 1 : 10,000 to 1 : 5,000 solution of potassium permanganate either by low pressure irrigations or by gentle hand injections by means of a syringe.

2. By means of a bulb syringe not more than 6 c.c. of a 5 to 10 per cent solution of mild protein silver (U. S. P.) or from 0.25 to 0.5 per cent strong protein silver (U. S. P.) is injected into the urethra and kept there for five minutes. (The weaker strengths are better.)

3. Such treatments are carried out daily until there is no urethral discharge and then every other day. If the latter interval proves too long, as evidenced by the recurrence of discharge, daily treatments should be resumed for a few days and the interval again increased. Later, when safe to do so, the interval is increased to every third day.

4. If the patient cannot visit the physician frequently enough for this regimen to be carried out, a one-eighth ounce glass syringe and 0.25 or 0.5 per cent solution of strong protein silver (U. S. P.) is ordered with instructions to use it twice a day.

5. It is safest not to try the ordinary tests of cure for patients under either of these two plans of treatment before the end of the fifth week in the most favourable of cases. (This does not apply to the real or seeming sulphonamide successes.)

6. Every effort should be made to obtain the patient's co-operation and no local treatment should be placed in his hands without the most explicit instructions as to their proper use.

7. Such patients should have described to them the symptoms of posterior urethral involvement and told to stop local treatment and present themselves at the physician's office if they occur.

*Posterior urethral involvement.*—1. Local urethral treatments should be stopped until the acute symptoms subside.

2. Acute symptoms can be controlled with sedatives and hot hip-baths.

3. After vesical comfort has been regained entirely, low pressure intravesical irrigations of potassium permanganate solution should be given at intervals of two or three days.

4. Prostatic or seminal vesicular manipulations should be avoided until the second glass of urine is clear and the first is almost clear.



5. One should start massage with the very gentlest prostatic strokings and, if it causes a return of urethral discharge, one should wait a week before trying again. If it causes no such recrudescences of symptoms it should be repeated at intervals of from three to four days, the pressure being gradually increased at subsequent visits but never reaching a point of roughness.

6. The massages should be continued at these intervals until the prostatic secretion is free of pus.

7. During the first month or six weeks of prostatic massage it is well to carry out a preliminary intravesical irrigation, some of the solution being left in the bladder to be voided after the massage. If after this time the irrigations are discontinued, there rarely will be any shreds in the urine when the patient is ready for dismissal.

#### TESTS OF CURE

The use of sulphanilamide in gonorrhœa has thrown a deep cloud of uncertainty over the older tests of cure. So true is this as to make it absolutely necessary to use methods that formerly were little needed in the male. Before this drug came into use one was almost 100 per cent safe in pronouncing a patient cured who had no urethral discharge and in whom a discharge could not be made to occur by the ingestion of alcohol, sexual excitement, the passage of a sound with massage of the urethra or whose discharge occasioned by a provocative injection of 1 per cent silver nitrate failed to show the gonococcus.

On those patients seemingly cured by sulphanilamide these simple procedures are sadly lacking in value, for such patients rarely experience a recrudescence of symptoms after the three first procedures, and their discharges commonly fail to show gonococci after the use of silver nitrate even though the gonococcus is present in the tissues. The safety of the patient and the protection of his possible contacts demand more careful tests of cure than these. In them the most careful and repeated searches of the washed sediments of the first urine voided following the aforementioned tests of cure should be carried out. Before such urine is voided the prostate, seminal vesicles and urethra should be stripped, so that their fluids are in the urine. Added to this, cultures for the gonococcus assume a place of enormous importance. And, no matter how carefully all these tests are carried out, some infected persons are almost sure to be passed back into sexual activity. Complement fixation tests are of little aid in the pronouncement of cure.

Because of the inferential character of all tests of cure, every patient should be warned against coitus without the use of a condom for some weeks after supposed cure.

#### OTHER TREATMENTS

An article such as this would be incomplete if no mention was made of biologic substance such as vaccines, filtrates and antitoxins, and prolonged hyperthermia. The biologic substances can be dismissed with the statement that, as a class, they have given about the poorest results of any seemingly sensible treatment.

Prolonged hyperthermia cannot be dismissed in so summary a fashion. That prolonged elevations of the body temperature above 106°F. will cure gonorrhœa in many cases is beyond question. That lower temperatures are less efficient and require more sessions of treatment also is established. It is equally certain that the method has dangers that are not to be viewed lightly and a mortality far greater than has the disease itself. The method requires equipment, trained personnel and time, which puts it out of the reach of the masses except, perhaps, when it is done experimentally. It is the opinion of Carpenter and Warren and their co-workers, who have done the most scientific work along these lines to date, that, in the male, it should be used for only those patients who resist cure by other methods and in the treatment of the graver complications of the disease. Such a view limits the urgent need for prolonged hyperthermia to a point where a physician has no cause to feel that

he is guilty of denying his patient the best because he does not urge it. Almost all cases of gonorrhœa in the male can be cured by other means and few of the complications, other than arthritis, are of such gravity or so resistant to treatment that they do not subside within a short time under less dangerous and less uncomfortable modes of attack.

### Histaminase in the Treatment of Allergic Dermatoses

By L. C. GOLDBERG, M.D.

(From the *Journal of the American Medical Association*, Vol. CXV, 10th August, 1940, p. 429)

THE discovery by Best and McHenry of an enzyme which specifically inactivates histamine suggests its use in the treatment of allergic cutaneous disorders. It has been shown that there is a release of so-called H substance in the blood during allergic shock and that this H substance may be histamine. Innumerable writers have endeavoured to demonstrate the fact that histamine must be the trigger mechanism which prepares the skin for various reactions, particularly the so-called triple response of vasodilatation (streak), wheal exudative (œdema) and reflex nervous dilatation (flare), which is dermatographism or urticaria itself. If this fact is true, then the assumption that treatment of these allergic states with histaminase is well founded and worthy of an extended trial before being discarded as another false hope in the long list of attempts to combat the allergic dermatoses.

Histamine may be obtained from the liver, lungs, skin, and other body tissues in a pure form under aseptic conditions. It is preformed in the cell in a slightly inactive form and is readily released into the surrounding area. This release is not entirely dependent on the destruction of the cells but may occur when the cells receive stimulation of a certain intensity, and the magnitude of this stimulation is dependent on the allergic irritability of the individual cells. The fact that very little histamine is found in the urine after the intravenous injection of large amounts of the substance led Best and McHenry to study distribution, properties and action of the substance or system producing this inactivation.

Histamine inactivating material was first demonstrated in horse lung and subsequently in beef lung, liver and kidney. The kidneys, duodenum, jejunum and cæcum each inactivated the greatest amount of histamine, and the kidney was more active than any other tissue in inactivating histamine.

Histaminase is a compound of physiologic albuminoid substance obtained from the intestinal mucous membrane. It is a loose white powder which is stable and dissolves in water to a slightly opalescent fluid. This preparation is put up as a dry powder of 2 histamine detoxicating units and in tablets enterically coated of 5 units. The unit is the amount necessary to inactivate 1 mg. of histamine during twenty-hour hours' incubation at 37°C. in a phosphate buffer solution at a pH of 7. Chemically histaminase is diamineoxydase. The change produced in histamine during inactivation appears to be oxidative since it is inhibited by potassium cyanide, and under anaerobic conditions it is accelerated by oxygen. It is suggested that rupture of the iminazole nucleus occurs in the histamine or that a complex non-dialyzable compound is produced. Reduction of the iminazole value parallels the degree of inactivation of histamine.

Roth and Horton determined the normal response of gastric acidity to subcutaneous injection of histamine. Several days after the response had been accurately established, histaminase was introduced into the duodenum from twenty-five to thirty minutes before the subcutaneous injection of histamine. This practically abolished the rise of gastric acidity. Likewise subjects were immersed in water at 24°C., and the curve of their gastric acidity under such conditions was similar to that caused by histamine. As before, the introduction of histaminase abolished the rise in gastric acidity. In

similar fashion, when histaminase was injected intramuscularly thirty minutes before the usual subcutaneous injections of histamine, the rise in gastric acidity was abolished. This is physiologic evidence that histaminase administered to man will inhibit the action of histamine and contrary to the work of Atkinson and Ivy, although they injected their histaminase intravenously instead of introducing it directly into the duodenum.

Karady and Browne carried out experiments to determine what effect pretreatment with histaminase might have on histamine and anaphylactic shock in animals. They used thirty guinea-pigs. The jugular vein of twenty pigs was exposed under slight ether narcosis and 3 units of histaminase dissolved in 2 c.c. of physiologic solution of sodium chloride was injected. In fifteen minutes all thirty received 4 mg. of histamine dihydrochloride intra-abdominally. In from five to seven minutes all the non-treated animals were in histamine shock; seven died. Two of the pretreated animals died in thirty-five minutes; all the rest survived. Thirty guinea-pigs were sensitized with 3 c.c. of 50 per cent egg white subcutaneously. From two to three weeks later twenty guinea-pigs were injected with histaminase under the same conditions as previously described. After fifteen minutes all received 2 c.c. of 50 per cent egg white intra-abdominally. Four of ten animals of the control group died in from ten to fourteen minutes; all had symptoms of anaphylactic shock in four or five minutes. None of the pretreated group died.

Horton and Roth described a case of hypersensitivity to cold, which case they had followed since 1927. They concluded that urticaria produced by hypersensitivity to cold was due to an overabundance of histamine. They treated their patient with subcutaneous injections of 0.1 mg. of histamine dihydrochloride weekly in an effort to increase the patient's tolerance to histamine. The patient improved. Later they treated a similar case with histaminase, administering 67 units in four and one-half days. He too improved.

Gilbert and Goldman prepared bronchioles for microscopic examination. The size of the bronchiole was recorded by the use of camera lucida. The addition of 3 mg. of histamine acid phosphate usually resulted in complete closure of the bronchiolar lumen. The preparation was observed for about ten minutes in order to rule out spontaneous relaxation and then the test drug was added. Histaminase caused slight dilatation of histamine-poisoned bronchioles in three experiments and no effect in two. After twenty-four hours' incubation at 37°C. a mixture of histaminase and histamine caused marked contraction of normal bronchioles in four experiments. Their conclusions were that histaminase is unable to prevent the action of histamine on these preparations.

Foshay and Hagebusch believe that serum sickness with its urticarial manifestations is due to release of

histamine in the tissues and circulation consequent on the union of serum protein antigens and antibodies. Six of eight patients with serum sickness received complete relief from 5 units of histaminase given orally three times daily. Within thirty-six hours all these patients had relief from their intolerable pruritus, patchy erythema and urticaria. Twelve patients were treated twice daily with the injectable form. Within seventy-two hours none of the patients had any further symptoms. They expressed optimism for the prophylactic use of histaminase in the prevention of serum sickness and further stated that this method of treatment is the only rational, genuinely effective and safe remedy known for this distressing condition. Moldenshardt treated five patients who had cutaneous disorders with histaminase, two of whom had eczema, one Quincke's edema, one moist erythema associated with marked pruritus and one serum sickness following diphtheria antitoxin injections. All responded and recovered within a short time. Adelsberger reported excellent results with histaminase treatment in three cases of allergic eczema on a nutritional basis and one case of light dermatitis. Hartmann stated that twenty-five patients with severe acne conglobata who had failed to respond to all types of medical treatment showed remarkable improvement after four or five injections of histaminase. In most of the twenty-five cases there existed some digestive disorder. Blecha treated twelve children who had allergic eczema with oral and intramuscular histaminase; five were completely cured, three greatly improved and the remainder were unaffected. Laymon and Cumming treated seventeen patients who had urticaria with histaminase and recorded the following results: 59 per cent cured, 12 per cent improved and 29 per cent unimproved; no definite improvement in eight cases of atopic dermatitis, and it was of no value in two cases of dermatographism. Forman stated that this therapeutic agent offers a new and helpful approach to the treatment of urticaria, angioneurotic edema and atopic dermatitis. In his report of thirteen cases of urticaria, all but one showed improvement, two of three cases of atopic dermatitis showed improvement, two of four cases of contact dermatitis showed improvement and one case of pruritus was controlled by histaminase. Urbach reported the successful treatment with histaminase of a woman aged 31 with severe purpura; vitamin C had been tried without any beneficial results. He concluded that in this instance the purpura was due to a deficient detoxifying function of the intestine. Matras, in discussing this case, mentioned one of chronic urticaria which had not been benefited by injections of histaminase. Baker reported two cases of cold urticaria which responded to treatment with histaminase. The first patient had a severe generalized headache, palpitation and general tremulousness associated with the urticaria. These symptoms subsided with the onset of the localized

#### *Treatment with histaminase*

Diagnosis	Number of cases	Results	Comment
Twenty-five cases under oral treatment			
Papular urticaria ..	1	Clinically cured	Histaminase used alone.
Atopic dermatitis ..	3	Improved	Histaminase in conjunction with other therapy.
Dermographism ..	2	Unimproved	Histaminase used alone.
Allergic eczema ..	3	2 unimproved	Histaminase in conjunction with other therapy.
Chronic urticaria ..	13	1 improved 8 clinically cured	Histaminase used alone.
Idiopathic pruritus ..	3	5 unimproved Slight improvement	Histaminase used alone.
Ten cases under injection treatment			
Chronic urticaria ..	10	All improved	Fever up to 102°F. after first injection, general malaise, pain at site of injection; mild rises in temperature after second and third injections, very little thereafter.



cedema. Histaminase tablets were used simultaneously with gradual desensitization to cold. The results of the treatment were most gratifying. The second patient was treated similarly with the same good results. Kile and Rusk treated a patient who had cold urticaria with histaminase without any results. They did not mention the amount used or the length of time it was tried. Miller and Piness treated forty-two patients with histaminase; twenty-nine had urticaria, and only five were relieved; five had allergic dermatitis, and none were relieved. They felt that in no instance could this relief be unequivocally attributed to the use of the enzyme. They reported few untoward reactions.

The histamine-histaminase reaction is an oxidative one, and as yet I have observed no untoward reactions. There is no need to worry about the type of reactions that occur when a patient is treated with small doses of histamine such as flushing of the face, shivering or faintness, fall in blood pressure, rise in pulse rate, headache, anginal pains in the chest or shock.

My purpose in this paper is to picture the results of treatment of various allergic cutaneous disorders with histaminase, orally and by injection, and to demonstrate that it might be a valuable adjunct in the management of these cases. All the cases studied were taken from private practice and analysed from the clinical point of view. In some of them histaminase was used by itself while in others it was a part of the advised therapy. When it was not the only therapeutic agent, the patients had been rebellious to other routine treatment measures. Twenty-five patients received histaminase by mouth; these may be subdivided as follows: thirteen had recurrent urticaria, three allergic eczema, one papular urticaria, two dermatographism, three atopic dermatitis, and three pruritus. Ten patients with recurrent urticaria received intramuscular injections of histaminase 2 c.c. every other day for a minimum of six injections and a maximum of twelve. The initial reactions of fever, malaise and joint pains following intramuscular injections of histaminase in 2 c.c. doses suggest the possibility of a foreign protein reaction. However, the same type of reaction does not always occur after the second or third injection, which does not hold true for reactions following injections of whole milk and other non-specific proteins. This requires further investigation of the injectable material. All the patients so treated showed marked improvement, and after treatment was discontinued no recurrences have been noted up to the present time.

#### SUMMARY

This group of thirty-five cases is too small a series to permit any dogmatic statements. In several cases the use of histaminase alleviated all the symptoms while in others it was a very useful factor in controlling the pruritus. Histaminase is no more a cure-all for allergic cutaneous conditions than are allergens the sole major excitants in the same diseases. Furthermore, it must be remembered that histaminase is a protein preparation and probably contains a variety of proteins which might cause reactions in patients whose allergy is of a protein type. It is possible that treatment with histaminase may give the epidermal structures relief from histamine excitation and help it build tolerance to histamine in the same way that intravenous injections with histamine in the treatment of chronic urticaria produces a gradual unresponsiveness of the skin to 'H substance', which is thought to be responsible for whealing, as believed by Alexander. I know that there has been no established fact that histamine is the causative agent in any pathologic condition and that most of the present data may be presumptive. Nevertheless evidence has been presented showing that histaminase oxidizes histamine in the body and on this basis its therapeutic assistance in the treatment of allergic dermatoses may be justifiable.

#### CONCLUSION

Histaminase oxidizes histamine in the body and is a helpful factor in the treatment of allergic dermatoses. A small group of thirty-five patients with various allergic dermatoses was treated with histaminase, orally

and by injection. There was partial or total improvement noted in all but nine of the patients treated. I can draw no definite conclusions regarding the dosage of histaminase, since each case must be studied individually. However, as yet no untoward reactions have been noted after patients have taken as much as 150 histamine detoxicating units daily for four or five days. Patients receiving intramuscular injections of histaminase had very much better results than those receiving the enzyme in tablet form. The first four injections elicited symptoms comparable to those following foreign protein shock therapy. Further clinical and laboratory data are necessary before any definite conclusions can be drawn regarding the specific value of histaminase.

### The Therapeutic Use of Sulphathiazole

(From *International Medical Digest*, Vol. XXVII, December 1940, p. 373)

SINCE prontosil initiated the era of chemotherapy, of which Paul Ehrlich dreamed 40 years ago, each new member of the sulphanilamide group has been enthusiastically received. This has been largely due to the amazing results which have been obtained from the earliest days as well as the almost unbelievable successes attained with each new preparation shortly after its appearance. Sulphathiazole, an analogue of sulphapyridine, is the latest of this group. Its predecessor, sulphamethylthiazole, introduced chiefly to combat staphylococcus infections, was soon abandoned, after its release from the experimental laboratory, because of serious reactions, which have been overcome to a large extent by the introduction of sulphathiazole.

**Pharmacology.**—Chemically, sulphathiazole (2-sulphanilylaminothiazole) is closely related to sulphanilamide and sulphapyridine. Its empiric formula is  $C_9H_8N_4O_2S_2$ , and its molecular weight is 255. The melting point is  $200^{\circ}\text{F}$ . and its taste is slightly sweet. It is poorly soluble in cold water, more soluble in hot water, but easily soluble in alkalies and alkaline earths with the formation of salts, such as the sodium salt, which is stable in concentrations up to 20 per cent. Apparently, sulphathiazole is most effective when a concentration of 3 to 6 mgm. per 100 c.cm. of blood is maintained. This may be accomplished one hour after the oral administration of a single dose of sulphathiazole, when a blood level of 4.5 mgm. per 100 c.cm. of blood is reached. Such a level remains optimally for four to six hours, and as a consequence it is desirable to administer it at four-hour intervals. Absorption of the drug from the intestinal tract is apparently satisfactory, but it does not pass readily into the spinal fluid. For this reason, it should not be relied upon in the treatment of any infection of the meninges.

Following its intravenous administration, it is easily recovered in the urine and practically all of it is eliminated within 24 hours. This is an additional reason why its administration at 4-hour intervals is desirable if we expect to obtain and maintain an optimal blood concentration of 4.5 mgm. per 100 c.cm. of blood. The urinary output of sulphathiazole is, however, not as great as sulphapyridine, so that the concentration in the urine might be higher. It therefore becomes important to maintain an adequate fluid output by administering sufficient fluids during its use.

**Toxicity.**—It is too early to know all of the contraindications and side-effects of sulphathiazole. It would therefore seem desirable to proceed cautiously in any patients who have previously suffered a toxic reaction in the course of therapy with sulphanilamide or sulphapyridine. Furthermore, the indiscriminate use of sulphathiazole in comparatively insignificant infections should be avoided.

So far, *nausea* and *vomiting* have been less frequent and milder than with sulphapyridine, and usually subside even with continued administration. These two symptoms have been rarely severe enough to necessitate discontinuing the administration of sulphathiazole. Other toxic effects are *vertigo*, *headache*, and *malaise*, but it is questionable as to whether these are due to

the drug or the infection which is being treated. *Hæmaturia* may sometimes be persistent between the first and tenth days, and when it occurs, it has been construed as an indication to stop the drug and force fluids. Because of this urinary manifestation, *dehydration* should be avoided by giving sufficient fluids to maintain the daily urine output at about 1,500 c.cm.

It is quite generally conceded that patients with severe grades of anæmia or low white blood cell counts have been treated with sulphathiazole without deleterious effect on either the red or white blood cell count. *Acute leukopenia with granulocytopenia* has been reported as occurring between the third and tenth days. It is therefore desirable to make daily blood counts during the course of treatment with this drug, and when there is an acute decline in the white cell count, with granulocytopenia, it is imperative that the drug be stopped immediately and that fluids be forced.

It is desirable to be alert to the fact that sulphathiazole may cause injury to nerve tissues. Symptoms attributable to nerve injury are less frequent since sulphathiazole has replaced sulphamethylthiazole. However, all early manifestations of *paræsthesia*, *interference with muscular contraction*, or pains of a neuritic nature call for immediate discontinuance of the drug.

Until more is known concerning toxic reactions, the administration of sulphathiazole should be discontinued just as soon as improvement in the patient's condition appears.

**Indications.**—So far, sulphathiazole is indicated chiefly in *staphylococcus infections*, and the results obtained have been as striking as in streptococcal infections when sulphanilamide is used. The use of the drug, however, in several thousand cases of *pneumococcus pneumonia* revealed results which closely parallel those obtained with sulphapyridine. In addition, beneficial effects have been recorded in both *pneumococcal* and *staphylococcal infections of the ear, nose and throat*, *urinary infections*, *colon-typhoid dysentery infection*, and in *hæmolytic and non-hæmolytic enterococcal infections*.

The chief use of the drug, however, seems to be in *pneumococcus pneumonia* and *staphylococcus infections*. The following procedures which have been compiled by Ciba Pharmaceutical Products, Inc., of Lafayette Park, Summit, New Jersey, one of the pharmaceutical houses through which sulphathiazole is available, serve as an excellent guide for the use of sulphathiazole in both of these conditions.

**Procedure in pneumonia.**—Before administering sulphathiazole:—

1. Obtain a sputum sample for typing, directly or by mouse inoculation.
2. Take a blood culture to determine the presence of a bacteriæmia.
3. Do a red and white blood cell count, a hæmoglobin determination, and a differential white cell count and urine examination.

**Dosage.**—The clinical acumen of the physician and the progress of the patient, and the laboratory procedures should be the ultimate guides for the dosage of sulphathiazole. Experience, however, dictates the following procedure:—

1. Administer the drug early.
2. Raise the blood plasma level of sulphathiazole in a rapid manner by the administration of a relatively large amount of the drug within a short space of time.
3. Maintain a blood level of 3 to 6 mgm. per 100 c.cm. of blood of the non-conjugated sulphathiazole. (Acetylsulphathiazole is inactive)

To accomplish the above, the following schedule for individuals over age 15 is suggested:—

1. Initial dose of 4 gm. (8 tablets).
2. After 4 hours and at 4-hour intervals, 1 gm. (2 tablets) night and day until the temperature has fallen by crisis or lysis and remains normal for 48 hours.
3. One gm. (2 tablets) every 6 hours for the next 24 hours.

4. If temperature, pulse and respiration remain normal, discontinue the drug at the end of this period. It is self-evident that the dosage in very old or debilitated patients has to be adapted accordingly by decreasing the dosage customary for the adult.

In infants and children, a dose of 1 gm. (2 tablets) per 15 pounds of body-weight up to 50 pounds, should be administered (0.15 gm./kg.). The accompanying table may be used as a guide to dosage.

**Sulphathiazole and serum.**—Specific horse or rabbit serum therapy together with sulphathiazole may be advisable in certain conditions:—

1. If pneumococcal bacteriæmia is present.
2. If a patient is over 40 years of age.
3. If treatment has not been started until after the third day of infection.
4. If two or more lobes are involved.
5. If other complications are present.
6. If the pneumococcal infection is of type 1, 2, 5, 7, 8, or 14.

Age	Approximate weight	Initial dose per os		Maintenance dose per os q. 4 h. (Day and night)	
		Gm.	Tab.	Gm.	Tab.
5	40	2.5	5	0.5	1
2	28	2.0	4	0.375	$\frac{3}{4}$
1	21	1.25	2½	0.25	$\frac{1}{2}$
$\frac{1}{2}$	15	1.0	2	0.165	$\frac{1}{3}$
$\frac{1}{4}$	12	0.75	1½	0.125	$\frac{1}{4}$

**Staphylococcus infections.**—Sulphathiazole should not be used in the treatment of minor staphylococcus infections such as localized boils and small carbuncles or in mild furunculosis. Furthermore, sulphathiazole should not be used in place of surgery. It should be used as an adjuvant to surgery. In large boils or carbuncles, with accompanying toxic symptoms, follow the same dosage as in pneumonia. In diffuse staphylococcal cellulitis, lymphangitis, or acute osteomyelitis, give dosage as follows:—

1. Initial dose of 4 gm. (8 tablets).
2. After 4 hours 1.5 gm. (3 tablets) every 4 hours night and day until the spread of infection appears to be under control.
3. Then 1 gm. (2 tablets) every 4 hours night and day and continue as indicated.

In staphylococcal bacteriæmia, prolonged treatment with sulphathiazole is indicated in order to prevent a relapse. Give:—

1. Initial dose of 4 gm. (8 tablets).
2. After 4 hours 1½ gm. (3 tablets) every 4 hours day and night until temperature has been normal for 48 hours.
3. Then 1 gm. (2 tablets) every 4 hours day and night for 14 days.
4. Then 0.5 gm. (1 tablet) every 4 hours night and day for at least another 14 days.

The daily dosage in children in these infections is to be calculated on the basis of 1 gm. (2 tablets) per 12 pounds (note: not 15 pounds as above) of body-weight (up to 45 pounds). The suggested schedule for these children is as follows:—

1. Initial dose 1 gm. (2 tablets) per 12 pounds body-weight.
2. After 4 hours the initial dose becomes the daily dose which is divided into six parts and is thus given at 4-hour intervals day and night until the temperature has been normal for 48 hours.
3. Reduce dose by one-third and continue for 14 days.
4. At this time reduce dose by one-half and continue according to clinical needs.

## Reviews

**LECTURES ON DISEASES OF CHILDREN.**—By Sir Robert Hutchison, Bart., M.D., LL.D., F.R.C.P., and Alan Moncrieff, M.D., F.R.C.P. Eighth Edition. 1940. Edward Arnold and Company, London. Pp. viii plus 471, with 107 illustrations. Price, 2fs.

THE fate of medical 'classics' would be a very interesting study. In many instances it would be better if they disappeared with their original authors from the medical stage, and made room for new books by writers of the younger generation. A compromise is possibly the best solution. How this compromise can be effected is exemplified in the book under review. Sir Robert Hutchison, president of the Royal College of Physicians, has certainly not yet retired from the medical stage but he has relegated the work of rewriting one of his 'classics' to a junior colleague, whilst he is still capable of exerting his influence on the teaching contained therein, not solely by virtue of his past experience. This ensures continuity of the spirit of the teaching, even when the letter has to be changed.

The title of the book is particularly appropriate; the chapters are lectures in more than name. One can visualize Robert Hutchison lecturing and see his movements and expressions. Perhaps younger readers can visualize Alan Moncrieff in the same way; we have not had the privilege of hearing him lecture. The book is one of the most readable we know. It is arranged for reading rather than for reference, but reference is facilitated by the judicious use of heavy type.

The lectures themselves deal with all subjects connected with the health and the diseases of children, but emphasis is laid on the simple and every-day ailments, rather than on the rare diseases. The fact that no attempt is made to deal with tropical disease is, in our opinion, evidence of the honesty of the writer. The book is well and appropriately illustrated, the page pleasantly readable, and the volume a handy one. We can recommend this book very strongly to the general practitioner.

**CHEMOTHERAPY AND SERUM THERAPY OF PNEUMONIA.**—By Frederick T. Lord, M.D., Elliott S. Robinson, M.D., Ph.D., and Roderick Heffron, M.D. 1940. The Commonwealth Fund, New York. Pp. ix plus 174. Illustrated. Price, \$1.00. Obtainable from Oxford University Press, Bombay and Calcutta

THIS handbook on pneumonia deals with the clinical features and diagnosis of pneumonia and its treatment by chemotherapy and serum therapy.

The book is divided into fifteen chapters. The first six chapters discuss the problem of pneumonia, the clinical features, methods of diagnosis—clinical and bacteriological, immunity factors in pneumonia, and the prognosis. The rest are devoted to a full discussion of chemotherapy and serum therapy, the details of mode of administration, indications, contra-indications, toxic effects and dangers of each type of therapy, and the results obtained by each separately and when administered together. Mass statistics collected from different parts of the world (the figures include those of two articles published in this journal in 1939) have been presented to show that the gross mortality of sulphapyridine therapy is 6.1 per cent, while with serum therapy the mortality was 12.5 per cent in type I and 20.5 per cent in type II pneumococcal pneumonia in America, where elaborate arrangements for serum therapy of pneumonia were made. In control cases, the fatality rate was about 25 per cent according to very conservative estimates. While the writers agree that chemotherapy yields much better results, they have emphasized the dangers of toxic effects to such an extent and have advised the adoption of so many bacteriological, biochemical, and hæmatological

examinations to prevent these, that this may discourage the general practitioner from using one of the most potent remedies against pneumonia. The reviewer fully agrees that the recommendations are scientific, but such elaborate laboratory facilities are not available in most parts of the world, and it will be a real tragedy if the general practitioner apprehensive of serious toxic effects, the risk of which is undoubtedly very small, should hesitate to treat any of his pneumonia cases by adequate dosage of sulphapyridine.

The book is a mine of information regarding modern methods of diagnosis and treatment of pneumonia, and as such will be found to be extremely useful by the medical profession.

P. C. S. G.

**THE HUMAN MIND: THE ORGAN OF THOUGHT IN FUNCTION AND DYSFUNCTION.**—By Murdo Mackenzie, M.D., M.R.C.P. 1941. J. and A. Churchill, Limited, London. Pp. vii plus 216. Price, 7s. 6d.

THIS is a very strange book. On page 37 we find the following statement: 'The reactions of Simplification are best described as Assertion on the one hand, and Depression on the other; qualifying Assertion by Immediacy, and Depression by Deliberation. The neuroses of Simplification are, then, Assertion and Depression; and the symptoms of Assertion are often experienced in clinical practice'. Admittedly it is a little unfair to take the above out of its context but even read with the context, it evokes in the reader's mind a sensation like that caused by the noise of clashing bells or the breaking of glass. One reads on, bewildered. In the last chapter the author brings his psychological technique to bear on the present war. We are informed that Nazi propaganda is the propaganda of a 'perverted Immediacy' in defence, and that 'its effect on the stable deliberate is inappreciable; much of it is rejected as absurd, and the rest as fatuous fussiness. But in a deliberate already the prey of persisting conflict, the effect of raising the intensity of the moment is to increase his pre-existing Anxiety', and so on. As a specimen of therapeutic procedure recommended by the author for combating mental dysfunction the following may be cited: 'The patient is first asked to look at the match-box on the consulting-room desk: the match-box is then removed, and he is asked to make a visual image of it and discuss matches, wood and any other chance association'. The simplicity of such procedure is commendable, but its therapeutic value is difficult to apprehend without some explanation but none is given.

O. B-H.

**THE THEORY OF OCCUPATIONAL THERAPY FOR STUDENTS AND NURSES.**—By Norah A. Haworth, M.A. (Cantab.), M.R.C.S., L.R.C.P., D.P.M., and E. Mary Macdonald. 1940. Baillière, Tindall and Cox, London. Pp. ix plus 132, with 81 illustrations. Price, 6s.

IN his foreword to this little book Sir Robert Stanton Woods very rightly calls attention to the fact that occupational therapy, in spite of being one of the oldest agents employed in psychotherapy (first introduced into English mental hospitals by Sir William Ellis in 1817), has only quite recently gained widespread recognition. Even now, its value is either not recognized or actively opposed in many general hospitals. In tuberculosis sanatoria and in the surgical wards of general hospitals, the employment of occupational therapy makes slow progress except in the United States. Sir Robert Stanton Woods is quite justified in describing this state of affairs as 'a grave reflection upon the medical profession'. In such circumstances this book on the theory and practice of occupational therapy should find a place in every up-to-date hospital. The authors discuss the subject from the standpoint of psychotherapy as well as from that of physiotherapy; the latter including orthopaedic and surgical

cases. There is an admirable exposition on the finance, equipment stocking, storage, and use of waste materials. This section of the book should be studied first by anyone who intends to introduce occupational therapy into a hospital or sanatorium. The term occupational 'therapist' is used throughout the book, although etymologically the correct term to employ is 'therapeutist'.

O. B-H.

**THE EARLY TREATMENT OF NERVOUS AND MENTAL DISORDERS.**—By W. Lindesay Neustatter, B.Sc., M.B., B.S., M.R.C.P. (Lond.). 1940. J. and A. Churchill, Limited, London. Pp. xii plus 370. Price, 15s.

In the 370 pages of this book the author sets forth an amazing amount of information. In the preface he states he has tried to write a book which will be of value to the general practitioner, the psychotherapist and the mental hospital psychiatrist. A commendable ambition! By far the most interesting and important part of the book is that devoted to the mental disorders of children and their treatment. It repays the closest study and will be found of great value not only to psychotherapists but to parents, teachers and social workers. The author recommends that 'mental hygiene' should concern itself solely with sexual hygiene. There is a great deal to be said for this, in view of the widespread existence of complete ignorance on sex and all that this term connotes. Dr. Neustatter appears to hold the belief that homosexual men and women seek treatment for their disability. If his opinion is based on his experience, one is forced to conclude that his experience has been very exceptional. Indian readers of this book who take an interest in psychotherapy will be saddened by the reflection of how very little is being done in this country as compared to what is being done for psychological medicine in Europe and the United States of America.

O. B-H.

**EMERGENCY SURGERY.**—By Hamilton Bailey, F.R.C.S. (Eng.). Fourth Edition. 1940. John Wright and Sons, Limited, Bristol. Pp. x plus 944, with 930 illustrations, of which a large number are in colour. Price, 63s.

This book is becoming an annual issue; the third edition appeared in 1938, it was reprinted in 1939, and the fourth edition appeared late in 1940. The important advances made during the last two years in many branches of surgery is the reason given for the publication of another edition, but a more material one was probably the exhaustion of the last edition and the certain demand for the book during these times of emergency.

For the benefit of those who are not familiar with this new world-famous book, we will quote from the preface—'when to operate, when not to operate, and how to operate under emergency conditions is the theme of this work'. If one has a criticism of this excellent book, it is that the emergency visualized is usually one of time rather than of place and equipment.

The changes in the present edition are numerous but they are not very prominent, and, should any prospective reader imagine that emergencies of everyday life have been sacrificed to war emergencies, we will relieve his mind by telling him that they have not; in fact no chapters have been devoted particularly to war wounds or air raid casualties, but the special emergencies that are likely to arise in these connections are dealt with in their appropriate sections. Beyond the written word, there is not the slightest sign of the war in this book, for the paper on which it is printed is of the same excellent quality usually used by the publishers of the *Journal of Surgery* and the illustrations are of the same superb quality. To produce such a book in war time reflects great credit on British character, and Britain's resources.

**PYE'S SURGICAL HANDICRAFT: A MANUAL OF SURGICAL MANIPULATIONS, MINOR SURGERY, AND OTHER MATTERS CONNECTED WITH THE WORK OF HOUSE SURGEONS AND OF SURGICAL DRESSERS.**—Edited by Hamilton Bailey, F.R.C.S. (Eng.). Twelfth Edition. 1940. John Wright and Sons, Limited, Bristol. Pp. xii plus 585, with frontispiece and 482 illustrations. Price, 21s.

WALKER PYE died nearly fifty years ago, but his spirit lives on in the world-famous book that bears his name. There can be little more than the spirit of his teaching left in the present edition, for the book is essentially devoted to descriptions of the use of 'gadgets', and mostly modern 'gadgets' to use a popular word. The writers prefer the word armamentarium, a word they have filched from the physician, who we feel will not resent the 'protection' that these surgeons are prepared to offer it.

The instruments whose uses are described range from the hypodermic syringe to the cystoscope; the minor surgical procedures include the opening or tapping of abscesses in almost all parts of the body (except the liver—an omission which might well be rectified in a subsequent edition); the treatments of burns, fractures and dislocations are detailed: the preparation of the patient for an operation and his after-care is given; and in fact this book includes almost all information on matters of technique that the house surgeon or the general practitioner can want.

Mr. Hamilton Bailey has mobilized a representative army of contributors, most of whom write obviously from personal experience. The descriptions of spleen and sternal puncture appear to be exceptions and suggest that the writer has taken these from other textbooks; we cannot believe that the statement, copied from text-book to text-book, that a hammer is usually required to drive in a sternal puncture needle can have any basis in practical experience.

However, the descriptions on the whole are excellent—well chosen, explicit and concise. The house surgeon will find it an invaluable aid in almost any procedure which he may be asked to undertake.

**THE HEAD AND NECK IN ROENTGEN DIAGNOSIS.**—By H. K. Pancoast, M.D., E. P. Pendergrass, M.D., and J. Parsons Schaeffer, M.D., Ph.D. 1940. Baillière, Tindall and Cox, London. Pp. xxxii plus 976, with 1,251 illustrations. Price, 69s.

This is a large book of over 1000 pages profusely illustrated by reproductions of skiagrams, anatomical drawings and diagrams.

As stated in the authors' preface the aim of the book is to correlate the basic and technical aspects of radiology with apposite facts in developmental and adult morphology, physiology, pathology, and observations in clinical medicine and surgery and the special branches of the last-named sciences.

This is a comprehensive undertaking. How well the authors have succeeded will be apparent only to those who have the need and the opportunity of consulting the mass of facts collected herein.

Detailed considerations of descriptive and physiological anatomy have been omitted and only those aspects which especially concern the radiologist are included.

In this way, and by careful selection of the matter available, as well as curtailment of unnecessary descriptions and discussions, the book has been limited to a single volume.

It is essentially a work of reference and as such should find a place on the shelves of practising radiologists and specialists in ophthalmic and nose and throat work.

The authors and publishers are to be congratulated on the presentation of the text and illustrations.

J. A. S.

**ANATOMY (HEAD AND NECK). PART III. Fifth Edition. Catechism Series. By C. R. Whittaker, F.R.C.S.E., F.R.S.E. E. and S. Livingstone, Edinburgh. Pp. 74. Price, 1s. 6d.; postage, 2d.**

THIS booklet is not new being a well-known member of the 'Catechism' series. In passing through four editions it has served the needs of many students, especially before the examinations, by enabling them to revise the whole text quickly yet without having to miss any of the important anatomical facts. The present edition, it is also hoped, will be serviceable to the same extent. The essential facts of the region have been very neatly compressed to the present size, very suitable for revision purposes, in the leisure hours in between long and detailed study of the voluminous text-books, which being presented in the form of answers to questions under each heading has acquired an added value.

While this book, along with others of the series, has, no doubt, considerable utility, we feel it very necessary to emphasize to those for whom it is meant that such works are never intended to replace the study of the main textbooks, but only to serve as a dependable compendium for recapitulation of the main and important structures, already read in the usual course of studies from textbooks. If therefore the book is used as is its designed purpose, there is hardly any to surpass it.

As to contents it is seen that the larynx is not included in part III (Head and Neck), but although the other parts are not before us, the larynx should, in our opinion, be included in the region of the head and neck.

S. C. S.

**SYPHILIS IN EARLIER DAYS.—By J. R. Whitwell, M.B., 1940. H. K. Lewis and Company, Limited, London. Pp. viii plus 89. Price, 5s.**

In this small volume the writer has presented extensive quotations from old literature, purporting to show the presence of a disease, the description of which is *very similar* to that of syphilis. The author's contention is that these writings show the presence of syphilis in different parts of the world centuries before

the sailors of Columbus returned to Europe from their voyage to America and were supposed to have brought syphilis to the old world. Those interested in the history of syphilis will find the book useful.

P. C. S. G.

**ORGANIZATION, STRATEGY AND TACTICS OF THE ARMY MEDICAL SERVICES IN WAR.—By Lieut.-Colonel T. B. Nicholls, M.B., Ch.B. Second Edition. 1940. Baillière, Tindall and Cox, London. Pp. xvi plus 488. Price, 15s.**

THIS is a book of the moment—or, should one say, an edition of the moment, for the first edition was published three years ago and was very well received. There are at the present time a large number of temporary officers in the Royal Army Medical Corps and Indian Medical Service who are preparing themselves for service in war areas. Many of them are probably feeling that they are wasting much valuable time and want to get on with the job, but that is always the way; very fortunately *all* the medical services are not busy *all* the time, and, during the waiting months, the inexperienced have an excellent opportunity to learn; they will find Colonel Nicholls' book a very valuable source of information.

The book is of course an elaboration of army manuals, but there is much additional information, and one is conscious of the touch of personal experience.

The book is divided into four main parts, on general organization and administration, the composition of medical units, and special organization, medical tactics and strategy, and a selection of exercises in medical strategy.

The new matter added in this edition includes the transport of casualties by air, medical services in connection with anti-aircraft work, and co-operation with civil emergency medical services.

The author has recruited a number of collaborators particularly for the new matter in which he lacks personal experience, so that the whole book is based on practical experience.

It is, as we said at the beginning of this review, a book of the moment.

## Abstracts from Reports

### ANNUAL REPORT ON THE WORKING OF THE CIVIL HOSPITALS AND DISPENSARIES IN THE MADRAS PRESIDENCY FOR THE YEAR 1939

**Number of hospitals and dispensaries.**—At the commencement of the year there were 1,322 medical institutions of all classes in this Presidency as against 1,325 at the end of the year 1939.

**The number of in-door and out-door patients treated in the State public, local fund, private aided and subsidized rural dispensaries. Beds.**—The total number of beds that were available in all classes of medical institutions for both the sexes in the year 1939 was 7,030 and 5,930 as compared with 6,856 and 5,590 in 1938. The total number of beds for women alone in these hospitals was 1,696 in 1939 as against 1,496 in 1938.

**In-patients.**—The number of in-door patients treated during the year 1939 was 342,811 as compared to 310,030 in the previous year.

**Out-patients.**—The total number of out-door patients treated in all the hospitals and dispensaries in the Presidency during the year 1939 was 19,499,555 as compared to 18,692,411 in 1938.

**Daily average.**—The daily average number of in-patients treated during the year 1939 was 14,600.03 as compared to 13,820.64 in 1938. The daily average number of out-door patients treated in the medical

institutions during the year 1939 was 142,199.03 as against 132,894.43 in 1938.

Among the various diseases treated in all classes of hospitals and dispensaries those that accounted for the largest number are shown below:—

Other diseases of the eye .. ..	1,439,157
Diseases of the ear .. ..	1,203,940
Ulcerative inflammation .. ..	1,411,073
Other diseases of the skin and nails excluding tumours .. ..	1,007,344
Injuries (general and local) .. ..	1,222,331
Diseases of the respiratory system other than pneumonia and tuberculosis .. ..	1,491,515
Other diseases of the digestive system excluding diarrhoea, dysentery and tumours .. ..	1,364,793

**Malaria.**—The total number of patients treated during the year under report was 1,111,024 with 371 deaths as compared to 1,276,658 with 386 deaths in the previous year.

**Dysentery.**—The number of patients, both amoebic and bacillary dysentery, treated during the year 1939 was 381,605 with 643 deaths as compared to 327,497 with 548 deaths in 1938.

**Enteric fever.**—The number of patients treated during the year under report was 26,013 with 902 deaths as compared to 24,290 with 726 deaths in the previous year.

# The Value of Dietary Supplements

*A Summary of Investigations\* published in the "Medical Officer," March 30 and April 6, 1935*

A NUMBER of children, all receiving their customary home diet, were given either No Supplement, Cod Liver Oil, Halibut Liver Oil (with milk to provide equal calories) or Virol. The experimental scheme provided that each child should have a period on each treatment in turn, in such a way that every possible sequence was included. Rigid statistical control was thus possible.

Gain or Loss in Weight on Various Supplements :—

Supplement	Total gain in ozs. over all periods	Average gain per child per week in ozs. over all periods	Total loss in ozs. during summer period only	Average loss per child per week in ozs. during summer period only
No Supplement - -	88	0.3	— 103	— 1.4
Cod Liver Oil - - -	287	1.0	— 77	— 1.1
Halibut Liver Oil with milk - - - -	333	1.2	— 184	— 2.6
VIROL - - - - -	762	2.6	— 7	— 0.1

Whereas earlier investigations had shown that the mere addition of vitamins had no effect on growth, these investigations have conclusively proved that Virol—a balanced food containing all the necessary vitamins—has a definite and remarkable effect in bringing the rate of growth up to the recommended standard. Virol was the only one of the supplements used that promoted this ideal rate of growth.

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\* The full report will be sent on application to Messrs. A. H. Wheeler & Co., Sudama House, Witter Road, Ballard Estate, Bombay.



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**THACKER SPINK** Publishers  
**CALCUTTA**



**Kala-azar.**—The total number of patients treated in 1939 was 1,697 with 18 deaths as against 2,263 with 20 deaths in 1938.

**Labour cases.**—During the year under report 127,318 labour cases were conducted in all classes of medical institutions of which 107,743 were normal and 19,575 abnormal as against 123,381 labour cases consisting of 104,244 normal and 19,137 abnormal cases during the previous year.

**Rural medical relief.**—The new scheme of training rural medical practitioners for the performance of public health work progressed satisfactorily during the year under review.

To avoid the overlapping of medical relief, Government have ordered the stoppage of payment of contributions by local bodies to private practitioners who have settled within five miles radius from a rural dispensary.

**Tuberculosis.**—In order to combat tuberculosis, the Madras Provincial Tuberculosis Association, with its various committees, was constituted and affiliated to the All-India Tuberculosis Association. The Association is making plans for opening clinics in all Headquarters Hospitals for the diagnosis and the treatment of patients in the initial stage. The proposal relating to the transfer of the Tuberculosis Hospital in Madras to the Sanatorium at Tambaram and to develop it so as to have a well-equipped unit on modern lines has been approved and a beginning made but for financial reasons it may be some time before the transfer is completed.

During the year under review a post-graduate course of lectures on tuberculosis was held at Madras and Madanapalle under the auspices of the Tuberculosis Association of India, and 24 candidates attended the course.

**Anti-leprosy campaign.**—During 1939 the British Empire Leprosy Relief Association established its headquarters at the Lady Willingdon Leper Settlement, Chingleput. The control over certain specialized clinics was handed over to the association.

The work done during the year under report is as follows:—

Investigation into the causes of various types of leprosy and the factors which led to their development among children is being conducted at Saidapet. The rural investigation unit has been continuing to do active work. Investigations are being pursued on the study of various types of diseases and influence of diet on the course of development at the Lady Willingdon Leper Settlement, Tirumani. Preliminary surveys by the Urban Investigation Unit have been carried out with the co-operation of the Madras Branch of the Provincial Council of the British Empire Leprosy Relief Association.

**Building schemes.**—During the year the following medical buildings were completed or nearly completed:—

- (1) A septic ward of 52 beds in the Government Rayapuram Hospital, Madras.
- (2) An additional ward of 88 beds in the Government Victoria Caste and Gosha Hospital, Madras.
- (3) Additional blocks in the Government Mental Hospital, Madras.
- (4) An additional ward of 18 beds in the Government Tuberculosis Sanatorium at Tambaram.
- (5) A new out-patient block in the King George Hospital, Vizagapatam.
- (6) The new Headquarters Hospital, Cocanada.
- (7) The new Headquarters Hospital, Madura.
- (8) The buildings connected with the remodelling scheme of the Government General Hospital, Madras.

Sanction has also been accorded for the construction of a maternity and children's ward and an extension to the Pathology Block of the King George Hospital, Vizagapatam.

**Medical education.**—Consequent on the establishment of a second Medical College in the Madras City, a

central institute of Anatomy and Physiology including Organic Chemistry and Biochemistry was organized from January 1939 at the Madras Medical College, so that the students of the Madras and Stanley Medical Colleges might be taught in one place. A course for the B.Sc. degree in Pharmacy was instituted in the Madras Medical College from July 1939. The record of the work of the medical educational institutions continued to be satisfactory.

The training of candidates for the diploma course in medical radiology and for the certified Radiological Assistants' course was started during the year under review. The M.B.B.S. degree of the Andhra University has been granted temporary recognition by the Medical Council of India for a period of two years from 1st December, 1938.

**Honorary medical system.**—The replacing of salaried medical officers by honorary medical officers was carried on during the year. Fifteen posts of Civil Assistant Surgeons in the city and the mofussil were filled by honorary medical officers. Orders were issued throwing open a large number of paid posts of Civil Assistant Surgeons and Sub-Assistant Surgeons in hospitals to honorary medical officers. The intention was that these posts should be filled by honorary medical officers as vacancies arise. A certain number of supernumerary posts for honorary medical officers were also filled. The Government have recently consulted all the recognized medical bodies in the Province on the honorary system and the question of modifying the scheme is under consideration.

**General.**—The work of medical-relief in this Province has shown marked improvement during the period under report. The number of hospitals and dispensaries has increased and the number of beds has also correspondingly increased. It is gratifying to note the increase in the daily average attendance of in- and out-patients which indicates the popularity of the allopathic medical institutions. The expansion of the x-ray facilities has given more impetus for the correct diagnosis and efficient treatment to patients.

#### ANNUAL REPORT AND STATISTICS OF THE KING GEORGE HOSPITAL, VIZAGAPATAM. FOR THE YEAR 1937

EIGHT cases of pellagra were admitted during the year.

During the year 34 cases of rheumatic infection were admitted. Nine were of acute rheumatic fever with polyarthritis and no cardiac involvement. The remaining 25 cases showed cardiac involvement; of these 10 were males, 12 females and 3 children. Of the 10 males, one had aortic regurgitation in addition to mitral disease. Of the 12 females, 3 cases were of pure mitral stenosis; 3 showed both mitral and aortic disease; the 3 children had rheumatic carditis. There was one case of chorea admitted on the female side.

Six cases of beri-beri were admitted and some of them were treated with a full course of Betaxin with marked improvement.

A case of particular interest was one of endothelioma of the pleura, which was admitted with pleural effusion which was found to be hæmorrhagic; on investigating the cause of this hæmorrhagic effusion, it was found to be due to endothelioma of the pleura.

The following is a brief account of interesting cases that have been admitted and treated under the care of the First Surgeon during the year 1937:—

**Congenital megacolon cured by peri-arterial sympathectomy.** A boy, aged 12, was admitted on 25th November, 1937, with threatening intestinal obstruction, but the pain, distension, etc., were relieved by enema. The sigmoid colon could be felt occupying the whole of the hypogastric and right iliac regions, was tender and contracting with colicky pains. Barium enema confirmed the distension of the whole colon. Laparotomy done on 20th December, 1937, revealed the sigmoid colon to be greatly enlarged, stretching right across to the right side, its walls thickened, mesocolon hypertrophied. Recto-sigmoid junction appeared to

be markedly thickened and irregular. On a diagnosis of Hirschsprung's disease, peri-arterial sympathectomy was done for a distance of 2 inches along the course of the inferior mesenteric artery to the point where it rose from aorta. Sigmoid anchored to left iliac fossa.

Uneventful post-operative course. Bowels moved regularly twice daily from the third day after the operation. For over a month the boy was under observation and during this period, there was no need to give enema or aperients for moving the bowels, whereas before admission the boy used to have one motion in five or six days. Clinical evidence of improvement was confirmed by barium enema and skiagram.

*Transplantation of both ureters.* K., aged 20, was admitted on 18th June, 1937, for traumatic rupture of urethra (intra-pelvic) and fractured pelvis for which supra-pubic drainage had to be instituted. This ultimately resulted in an intractable stricture of the urethra, with persistent supra-pubic urinary fistula. After several unsuccessful attempts to restore the patency of the urethra, it was decided to transplant the ureters to relieve the patient of the discomfort of a supra-pubic fistula. The right ureter was transplanted into the sigmoid colon on 22nd October, 1937, and the left one on 22nd November, 1937. On both occasions the patient had an uneventful post-operative course. Renal function remained satisfactory. Patient was seen three months later in quite good health. Further follow-up has not been possible as the patient did not turn up as advised.

Mr. M. G. Kini was in charge of the second surgeon's wards. To find out the incidence of cancer an attempt was made to record all cases that sought advice, both out-patient and in-patient, in a separate register. The result of this tabulation has been published in a paper entitled 'The Problem of Cancer' in the *Indian Medical Gazette* (Volume LXXII, November 1937). The tabular statement collected from cases from 1931 to 1934 shows the regional incidence of cancer. There were 52 cases of the cancer of palate, 52 cases of cancer of penis, 50 cases of cancer of tongue, and 46 cases of cancer of breast in a total of 335 cases. Cancer of the large bowel also showed a large incidence. Eighteen cases out of 335 were cancer of the large bowel. It is interesting to note that all the cases of the cancer of the penis were among Hindus, confirming the findings of other workers in the field. All cases of the cancer of the palate gave a history of smoking of cigars with the fire-end inside the mouth, a peculiar habit particularly adopted both by the men and women of the poorer classes in this place. The chronic irritation resulting from the fire-end inside the mouth over a prolonged period caused the cancer of the palate in the same way as the Kangri cancer of the navel in Kashmir. There was a case of cancer of the penis in a child aged two years. Most of the cases of cancer of the breast that were admitted were in an advanced condition. Of the 46 cases of cancer, two were in men and 44 women. There was one case of sarcoma of the breast operated in 1934 and keeping perfectly fit up-to-date.

Four hundred and six cases with gastric or duodenal ulcers were admitted from the year 1932 to 1937 in a total admission of 4,416 cases, of these 261 were operated upon.

There was one case of rhinoscleroma which progressed relentlessly in spite of treatment with radium, arsenic, gold and iodine.

There were two cases of cancer of the middle ear cleft. Both were epitheliomata. Both gave a history of middle ear discharge.

There was one interesting case of *Encephalitis lethargica* admitted into E.N.T. wards as the most prominent and leading symptom was headache and pain in the left ear.

The patient, an European male, 30 years old, after a mild attack of nasopharyngeal catarrh was seized with a severe pain in the left ear and headache. His medical attendant sent him to the Ear, Nose and Throat Department of this hospital suspecting it to be a case of acute otitis with mastoid involvement. There was no past or present history of middle ear discharge.

The tympanic membrane was normal. There was no post auricular swelling or tenderness. X-ray of mastoid and sinuses revealed nothing abnormal. The idea of its being a mastoiditis was therefore ruled out and the patient was kept under observation. His behaviour was soon noticed to be peculiar. There was disorientation and irregular tremors were noticed in his tongue leading ultimately to paralysis. Three days later he developed right sided hemiplegia and conjugate deviation of eyes and died. Lumbar puncture and culture revealed no evidence of meningitis. It is unfortunate that no post-mortem examination could be held.

The pain referred to the ear seems to be a root pain in the course of a general disease, *Encephalitis lethargica*.

#### ANNUAL REPORT ON THE WORKING OF THE CIVIL HOSPITALS AND DISPENSARIES IN THE PROVINCE OF ASSAM FOR THE YEAR 1939. By LIEUT.-COLONEL L. A. P. ANDERSON, M.A., M.D., B.Ch., D.P.H., D.T.M. & H. (CAMB.), I.M.S.

COLONEL PHIPSON held charge of the Medical Department throughout the year under review and I have therefore thought it proper that the general comments on the working of the hospitals and dispensaries with which this annual report invariably concludes should be in his own words. At my request he has been good enough to send me the remarks he would wish to make and these are incorporated below—

'In my report for 1938 I drew the attention of Government to two of the directions in which the efficient working of the medical department is seriously handicapped; one, the deplorable lack of nursing facilities in the state and state-aided hospitals of the Province, the other, the lack of post-graduate medical training and the over-burdening of government medical personnel with clerical and other work which encumbers them in the discharge of their professional duties. I regret I am unable to report any progress in either direction, as Government have so far been unable to agree to the establishment of a training school for nurses in connection with the Dibrugarh Civil Hospital, nor to make provision for routine post-graduate training nor for clerical establishments in the larger hospitals.

In this report I take the opportunity of referring to certain other matters which have engaged my attention during the year under review. These concern the pressing need for economy in the use of drugs and other medical supplies necessitated, on the one hand, by diminishing budget grants under this head, and on the other, by the upward trend in the number of patients treated in hospitals and dispensaries, together with the rising prices of many drugs and medical requisites in common use. I have made certain suggestions to civil surgeons with the object of reducing the ever-widening gulf which separates what is really needed and what it is possible to purchase within the limits of the grants available. I know I can count on their help and co-operation, but their position is a difficult one which promises to become still more so if prices rise further and budget grants diminish.

During my inspections of subdivisional and other dispensaries I have encountered one pernicious result of enforced economy which is chiefly met with towards the end of the financial year—the dilution of mixtures containing essential drugs, particularly quinine, to a point at which the mixture ceases to be effective. There is no drug which is of greater importance to Assam than quinine, and the supply of quinine-mixture in a non-effective dose is a form of 'economy' which ought not to be tolerated for a moment. But what is the dispensary doctor to do? In the malaria season he is besieged by large numbers of patients clamouring for treatment, but all too often his stock of quinine is too small to last the year out, and no funds are available to cover supplementary indents, and in the latter part of the year, he must face one of two

alternatives: to refuse treatment (the result of which can be easily imagined) or to supply his malaria patients with reduced and ineffective doses, unless the dispensary is fortunate enough to receive a gratuitous supply of quinine from the public health department, a windfall which occurs but rarely. Statistical evidence of the conditions prevailing is afforded by the fact that expenditure on account of medicines on the 1,584,512 patients attending purely out-patient dispensaries in Assam during the year 1939 was no more than Rs. 90,960, equivalent to 11 pies per head and of course still less in the last few months of the year, when stocks are running low.

If we consider the treatment of malaria alone, the amount of quinine and cinchona available during the year 1939 for the 827,190 malaria patients attending all medical department dispensaries amounted to 3,705 lb., an amount which allowed 34.4 grains only for each patient. The minimum amount of quinine necessary for a full course of treatment is 168 grains, and it is obvious therefore that we are attempting to treat malaria in our dispensaries with a dose of quinine which on the average is little more than one-fifth of the dose required to effect a cure, which is of course what should be aimed at with patients attending medical department dispensaries. The discrepancy between the dose given and the effective dose is still greater in the case of those patients attending purely out-patient dispensaries, since the figure 827,190 includes malaria patients treated as indoor patients who are likely to receive full treatment. The amount of quinine and cinchona available for purely out-patients may therefore be taken to be even less than 34.4 grains per head.

How are these difficulties to be met? The remedies I have suggested to civil surgeons include the practice of the utmost economy in non-essential drugs, to enable larger quantities of essential drugs to be ordered, and the purchase of less expensive equivalents for the more popular and highly-priced foreign drugs. The remedies which I now suggest to Government for the consideration are (i) the allocation of increased grants for quinine; (ii) the maintenance of grants for the purchase of drugs at not less than the pre-war level; and (iii) the appropriation of all income derived from the 'One-anna' system, in all local fund dispensaries where it is in operation, not to revenue, but for the sole purpose of supplementing the funds at the disposal of the medical officer for the purchase of drugs and other medical requisites. In state dispensaries this principle is already in operation, but in my view it should be universal throughout the Province, as a recognized policy, and it would help to meet the difficulties, which are being experienced, in providing adequate medical relief for the sick poor of Assam.

## Correspondence

### SCORPION STING IN HUMAN BEINGS

SIR,—This note from me at such a late date of about five years after the incident may seem strange and surprising. Yet on account of the possible scientific utility of the facts I venture to put before you my observations of the cases of scorpion sting in human beings.

In the columns of 'Mirror of Hospital Practice' of the *Indian Medical Gazette* of July 1935 there is mentioned 'A case of scorpion "bite"'. It is the sting of the scorpion that is venomous and painful and not the bite. Likely no one has ever suffered from the 'bite' of the scorpion. To call the 'sting' a 'bite' is misleading and wrong.

Further allow me to add to the usual symptoms of scorpion sting enumerated in the attached note to the report, the following which have not been taken note of or probably not observed by the reporters. Within my experience as a medical man for the last 18 years in this town, I had occasion to treat several hundreds of cases of scorpion sting. I have observed in nearly

50 per cent of the cases where males were stung, a marked painful erection of the penis which does not subside even long after the pain of the sting subsides with treatment. This erection has been observed both among boys and elderly males in addition to the usual symptoms.

Among a few of the females stung, I had observed a similar painful excitement of the nipples; and fullness of the breasts. The patients complained of an appreciable warmth in the genital parts with erection of the clitoris in all probability.

This particular effect of the scorpion venom on the erectile tissue, I think, should be taken note of and investigated. It might prove to be a useful therapeutic agent as a sexual stimulant.

C. B. SUBRAMANYAM, L.M.P.

NELLORE,  
6th February, 1941.

## Service Notes

### APPOINTMENTS AND TRANSFERS

THE VICEROY AND GOVERNOR-GENERAL has been pleased to make the following appointment on His Excellency's personal staff, with effect from the date stated:—*To be Honorary Surgeon*

Colonel P. B. Bharucha, D.S.O., O.B.E., *vice* Colonel H. Stott, O.B.E., vacated. Dated 30th July, 1940.

Lieutenant-Colonel J. P. Huban, O.B.E., Administrative Medical Officer in Rajputana, will continue to officiate as Additional Deputy Director-General, Indian Medical Service, *vice* Lieutenant-Colonel R. F. D. MacGregor, C.I.E., M.C., granted an extension of leave.

Lieutenant-Colonel J. S. Galvin, Civil Surgeon, Dharwar, reverted to Military duty, with effect from the forenoon of 12th February, 1941.

Major B. M. Rao, an Officiating Agency Surgeon, on return from leave, resumed charge of his appointment of Medical Officer, Meshed, with effect from the afternoon of the 9th January, 1941.

The services of Major M. R. Sinclair, Civil Surgeon, Agra, have been placed at the disposal of Government of India, Defence Department, with effect from 14th January, 1941.

Major R. L. Raymond, on return from leave, resumed charge as Ophthalmic Surgeon, Rangoon General Hospital, on the forenoon of the 3rd February, 1941.

Major R. I. Reid is appointed as Director of Production, Instruments and Appliances, in the Office of the Director-General, Indian Medical Service, New Delhi, with effect from the forenoon of the 4th February, 1941. He will be on probation until further orders.

The services of the undermentioned Officers of the Indian Medical Service (Civil) are placed temporarily at the disposal of His Excellency the Commander-in-Chief, with effect from the dates stated against their names:—

Major M. K. Afridi, 12th August, 1940.

Major S. S. Bhatnagar, 15th October, 1940.

Captain R. L. Haviland-Minchin, 16th December, 1941.

### INDIAN LAND FORCES

#### (Emergency Commissions)

#### *To be Captains (on probation)*

Sarveshwar Nath Kaul. Dated 15th November, 1940, with seniority 15th November, 1932.

Chandu Vishindas Ramchandani. Dated 15th November, 1940, with seniority 24th March, 1936.

#### *To be Lieutenants (on probation)*

15th November, 1940

Pollapalli Nanjundasetti Ramachandra Setty.

Natesampillai Rangavadiyelu.

Marayath Govindan Naya.

Dineshchandra Ramchandra Vaidya.  
 Mohamed Ji Ahmadi.  
 Shiam Bihari Lal.  
 Nazir Ahmad.  
 Nirmal Kumar Roy.  
 Mohamed Sarwar Khan.  
 Ajit Singh Gharjakhia.  
 Sachindra Nath Mukerji.  
 Syed Hussain Razvi Shahid.  
 Valiaparampil Thomas Kuriyan.  
 Santi Pada Dutt.  
 Vaderbet Ramachandra Kamath.  
 Mirza Baqar Hasan.  
 Bhagwan Swarup Suxena.  
 Nirmal Chandra Roy.  
 Sailendra Chandra Das Gupta.  
 Padma Nava Bose.  
 Narayan Vishvanath Gharpure.  
 Krishnadhan Banerjee.  
 Lakshman Seshadri Nathan.  
 Tirupapullyur Thiruvengada Ramalingam.  
 Prasanta Kumar Chatterjea.  
 Anuhsinh Khenkarji Jadeja.  
 Monec Rustomji Vacha.  
 Arumbakam Nageswaran Ramanathan.  
 Rafique Ahmad Riyaz.  
 Rustam Cavashah Dorabji Tarapore.  
 Chaman Lal Kashyap.  
 Manjeri Venkatarama Sarma.  
 Anil Krishna Barat.  
 Bibhuti Bhushan Mandal.  
 Kamal Krishna Seal.  
 Jogendra Mohan Sinha.  
 Akbar Hussain Hamid.

16th November, 1940

Ahi Bhushan Roy.  
 Jampala Ramakrishnayya.  
 Manohar Genesh Pendharker.

18th November, 1940.

Bhaskara Memon Ambady.  
 Tarakad Ramakrishna Aiyar Vaidya Nath.

#### LEAVE

The leave granted in previous notification to Lieutenant-Colonel R. F. D. MacGregor, C.I.E., M.C., Additional Deputy Director-General, Indian Medical Service, is extended by 2 months.

#### PROMOTION

##### Captains to be Majors

R. M. Lloyd-Still. Dated 1st April, 1937, with seniority 17th May, 1936.

H. H. Mahmood. Dated 10th February, 1941.

Note.—The promotions of Majors H. T. McWilliams and I. Baksh to their present rank are ante-dated to 4th August and 8th October, 1938, respectively.

T. E. Palmer, O.B.E. Dated 2nd February, 1941.

3rd February, 1941

H. B. MacEvoy.

J. Guthrie.

Lieutenant (on probation) to be Captain (on probation)  
 T. J. Powell. Dated 5th December, 1940, with seniority 3rd August, 1940.

#### INDIAN LAND FORCES

(Emergency Commissions)

Lieutenants to be Captains

1st February, 1941

L. Nandkeolyar.

B. L. Kappor.

#### RELINQUISHMENT

The undermentioned officer relinquishes his commission on the ground of ill-health:—

#### INDIAN LAND FORCES

(Emergency Commission)

Lieutenant S. C. Das Gupta. Dated 1st February, 1941.

#### RETIREMENTS

Major-General N. M. Wilson, C.I.E., O.B.E., K.H.S.  
 Dated 23rd February, 1941.

The following retirement, with gratuity, is permitted:—

#### INDIAN LAND FORCES

(Short Service Commission)

Captain Z. H. Khan. Dated 3rd January, 1941.

## Notes

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## Original Articles

## TUBERCULOSIS OF THE FEMALE GENITAL TRACT

By M. N. SARKER, M.B., F.R.C.S., M.C.O.G. (Lond.)  
Professor of Clinical Midwifery, Medical College,  
Calcutta

B. P. TRIBEDI, M.B. (Cal.), D.B. (Lond.)  
Professor of Pathology and Bacteriology, Medical  
College, Calcutta, and Bacteriologist to the Government  
of Bengal

and

J. M. CHAKRAVERTY, M.Sc., M.B.  
Clinical Pathologist to the Gynaecological Services,  
Medical College Hospital, Calcutta

TUBERCULOUS infection of the female genitalia might occur either as a primary affection of the local site, or as a part of a general infection, the original lesion being in some other organ. Primary genital tuberculosis is rare, the commonest cause being secondary infection of the genital tract, either through the blood, lymphatics, or the peritoneum. Hence incidence of genital tuberculosis in the female is expected to show relationship with the extent of tuberculosis in the general population of any part of the country. Tuberculosis of the uterus presents features which are very similar to malignant disease and, as such, bring in very important complications in the diagnosis. Hence it seems desirable to have some idea of the prevalence of this type of abnormality in Bengal where tuberculosis is rampant.

In view of the above, we are recording our observations from the study of the material that we have collected during the last 20 years.

TABLE I

Showing tuberculosis of the female genitalia as seen from biopsy materials

Total number of gynaecological specimens during the period of 1920 to 1940 ..	3,744
Total number of uterine curettings examined ..	853
Tuberculous lesions found on histological examinations:—	
Curettings .. .. .	4
Uterus, body only .. .. .	3
Cervix only .. .. .	5
Tube and ovaries combined .. .. .	12
Combined body, cervix, tube and ovaries ..	1
Bartholin gland .. .. .	1
TOTAL .. .. .	26

A few cases that we have observed recently are described below:—

Case 1.—R. D., aged 35, came into the Eden Hospital, Calcutta Medical College, on 8th September, 1937, with the complaint of pain in lower abdomen for the last two years.

History.—She had two children—last one being born 17 years back. Both the deliveries were healthy. Menstruation stopped one year before her admission.

On examination.—The uterus was found to be anteverted and mobile; there was slight thickening of the

right parametrium. The cervix bled on examination. The external os looked unhealthy, granular and ulcerated. An early carcinoma of the cervix was suspected and panhysterectomy was done. On histological examination tuberculous infection of the cervix and fallopian tubes was found. No evidence of any tuberculous lesion anywhere else could be found on clinical examination. The patient was discharged on 23rd September.

Case 2.—S. M., aged 24, came to the hospital on 25th July, 1940, for repeated miscarriages and continuous discharge.

History.—First menstruation appeared at the age of 13 years; married at fourteen. She was quite healthy until two and a half years before her admission. She had altogether five pregnancies of which the first two were healthy. Two and a half years back she gave birth to a full-term dead child; the delivery was uncomplicated. About six months later she had another miscarriage. Since the birth of the dead child her periods (more properly the lochia) did not disappear fully but a continuous discharge with periods of exacerbation was going on all the time for which she came to the hospital.

A dilatation and diagnostic curetting were done on the 31st July, which on histological examination showed the picture of a tuberculous infection (figure 1); Mantoux's test was found to be positive in 1 in 1,000,000. On 30th August, 1940, another curetting was obtained which showed the same picture on histological examination. On 3rd September, a laparotomy was performed which showed the following:—

The greater omentum was found to be projecting downwards in a fan-shaped manner. It was adherent to the base of the urinary bladder. There was a good deal of adhesion in the region of left ovary and tube. The peritoneal surfaces of both the fallopian tubes and the left ovary were found to be studded with small tubercles. The appendix was retrocaecal. The base of the appendix and the caecum appeared to be much thickened and were studded with tubercles. The mesenteric glands in the pelvis seemed to be shotty but not enlarged. Other abdominal organs seemed to be normal. The uterus, the tubes and the left ovary were removed, which on examination showed the following:—

Both the fallopian tubes showed numerous miliary tubercles on the surface. On cutting these open it was found that both the tubes have become extensively involved with caseous tuberculous process, the lumen was completely occluded in several areas. At the site of junction of the tubes with the uterus on both sides there were caseating areas which contained cheesy material. The whole of the endometrial surface of the uterus showed a nodular appearance which was friable to the touch. At some areas actual hæmorrhages could be found. The cervical portion was also similarly involved with nodular areas and hæmorrhages (figure 2). There were also other areas of hæmorrhage which could be made out to be due to instrumentation during curetting. On making several incisions, through the body of the uterus it was revealed that tuberculous involvement took place throughout the organ. The left ovary was also similarly involved. There was a blood cyst within the ovary.

Histological examination of the different portions of the body of the uterus, endometrium (figure 3), cervix (figure 4), tubes and ovaries all showed typical tuberculous infection with very conspicuous giant-cell systems.

Case 3.—S., aged 40 years, was admitted into the hospital on 29th November, 1940, with history of fever for three months and white discharge per vaginam for the last eight months. She had amenorrhœa for eight months. There was a history of bleeding about a month before this period of amenorrhœa. She had four children of which three were living. The age of the last child was two and a half years. On examination the uterus was found to be normal in size but anteverted and pushed to the right side. A big tender mass was found to fill up the left side of the uterus and the pouch of Douglas. There was a small urethral

caruncle and cervicitis was detected. Urinary sediment showed a few pus cells and yielded no growth on culture.

Blood examination result:—Leucocytes—9,600 per c.mm., erythrocytes—2,700,000 per c.mm., hæmoglobin—50 per cent, polymorphonuclears—80 per cent and lymphocytes—20 per cent.

Formaldehyde and Chopra's tests were negative.

Stool examination showed much mucus, pus cells and red blood cells in fair number; culture showed only *B. coli*. The patient went downhill with continued pyrexia and died on 23rd December, 1940. The post-mortem examination showed the following:—

The greater omentum was seen to project downwards into the pelvic area in a fan-shaped manner and was adherent to the pelvic wall. There was bilateral plastic pleurisy. Miliary tubercles were found to be scattered all over the lungs with interlobar adhesions on both the organs. In the pelvic cavity a tubo-ovarian mass was detected on the right side. The tubes and ovaries were separated from the mass which was seen to be on the right side of the uterus occupying its whole length and some part of the posterior surface of the uterus. The uterus was densely adherent with this mass and with the rectum. On opening the mass thick yellow cheesy pus came out which yielded  $\beta$  hæmolytic streptococcus on culture.

Both the tubes were found to be thick and hard, and on cutting these open, caseating areas were seen (figure 5). Both the ovaries on section were found to be caseous and hæmorrhagic. On opening the uterus, the entire cavity was seen to be filled up with irregular protruding masses with hæmorrhages at places. The cervix was similarly affected and at the junction of the cervix and the corpus of the uterus a polypoid mass,  $\frac{1}{2}$  inch by  $\frac{1}{4}$  inch in size, was seen to protrude (figure 5).

The wall of the uterus was sectioned at several places and it was seen that throughout the organ there were numerous greyish-yellow areas with hæmorrhages. The wall of the abscess cavity was irregular and about  $\frac{1}{2}$  inch thick.

*Microscopical anatomy.*—Pieces from the lung tissue, liver and spleen showed typical picture of tuberculous infection. In the uterus, the endometrium was completely lost, and had given place to granulation tissue and necrotic areas within which there were many giant cells (figure 6). The wall of the uterus showed the same picture. The polypoid mass in the cervix was found to be a tuberculous granuloma. The ovaries and the tubes showed the same type of lesion. Several blocks were made from the wall of the abscess cavity in the right parametrium. Typical tuberculous lesion was also found there (figure 1). Besides these, Gram-positive cocci were seen in the tissue spaces and within the capillaries in the wall of the abscess (figure 8).

*Case 4.*—Miss H. A., a cinema actress, aged 25 years, had been suffering from profuse purulent leucorrhœa for some years. Four years ago she had a right-sided Bartholin abscess. Since then she had occasional attacks of pelvic peritonitis. The x-ray examination of the chest showed a small lesion at the apex of the right lung, and she was put under treatment for pulmonary tuberculosis. She continued to lose a good deal of weight. On 12th January, 1937, she was examined and was found to run a temperature of 100°F. There were pelvic inflammatory masses on both sides of the uterus. Gonococci were demonstrated from the secretions of the cervix and the right Bartholin gland. After a preliminary palliative treatment a supravaginal hysterectomy with bilateral salpingo-oophorectomy was performed. Convalescence was somewhat prolonged but otherwise normal. The tubes contained pus which was sterile on culture. No tubercles were present on the peritoneal surface of the tubes. There was an abscess in one of the ovaries. The uterus was normal in size. There was a fluctuant swelling on the anterior surface on the right side of the uterus. It was found to be an intramural abscess. On section the tubes and the walls of the intramural abscess showed numerous tubercles with typical giant cells. This patient did very well after the operation but complained of artificial

menopausal symptoms. She died of meningitis two years after the operation.

*Case 5.*—A., aged 43 years, a stout person, complained of menorrhagia for five years. She was married when she was 10 years of age and became a widow when she was 12 years of age. Never conceived. It was found that she had an interstitial fibroid about the size of five months' pregnancy. She was then suffering from glycosuria and hyperglycæmia. After careful dieting the sugar level came to normal and a subtotal hysterectomy was done on 5th September. Early in 1939 she was seen again when she complained of a small hard tumour on the labium majus. This was removed and on section showed tuberculosis of the Bartholin gland. The secreting acini and the duct were normal. There was a peri-acinal and inter-lobular inflammation separating the acini. The inter-acinal tissue was well supplied with blood vessels. Tuberculous giant cells were seen in series of sections. But the patient is alive now and does not show any tuberculous lesion anywhere.

From the cases detailed above and those incorporated in table I, the main complaints can be summarized as follows:—

- |   |         |   |
|---|---------|---|
| (a) Pain in the back and lower abdomen      | .. .. . | 4 |
| (b) Signs of cervical erosion with bleeding | .. .. . | 6 |
| (c) Tumour on the lower abdomen             | .. .. . | 9 |
| (d) Only bleeding and discharge             | .. .. . | 7 |

The age groups of the above 26 cases are given below:—

TABLE II  
Age distribution

10 to 20	.. .. .	1
20 to 30	.. .. .	17
30 to 40	.. .. .	4
Over 40	.. .. .	1
Not noted	.. .. .	3

Table I shows figures from biopsy material; this has the disadvantage of being incomplete, and naturally might not show the true picture. We have also collected the data from the post mortems on tuberculous females that were done during the last twenty years, i.e., the same period from which the biopsy material was collected.

The result is given below in table III. Tissues from all these cases of autopsies were, of course, examined histologically.

TABLE III

Total number of autopsies in females, 1920 to 1940	.. .. .	430
Total number of autopsies showing T. B. in females	.. .. .	67
Pure pulmonary	.. .. .	21
Pure intestinal	.. .. .	7
Pulmonary and intestinal combined	.. .. .	39
Uterus, ovaries and tubes showing combined T. B. lesions	.. .. .	4
Pure tubal tuberculosis	.. .. .	2
Percentage of T. B. in the genitals in cases of females where deaths occurred due to tuberculosis	.. .. .	8.9
Percentage of T. B. genitals in all female post mortems	.. .. .	1.1

#### Discussion and comments

From the above tables, I and III, it will be seen that from unselected gynæcological biopsy



PLATE XII

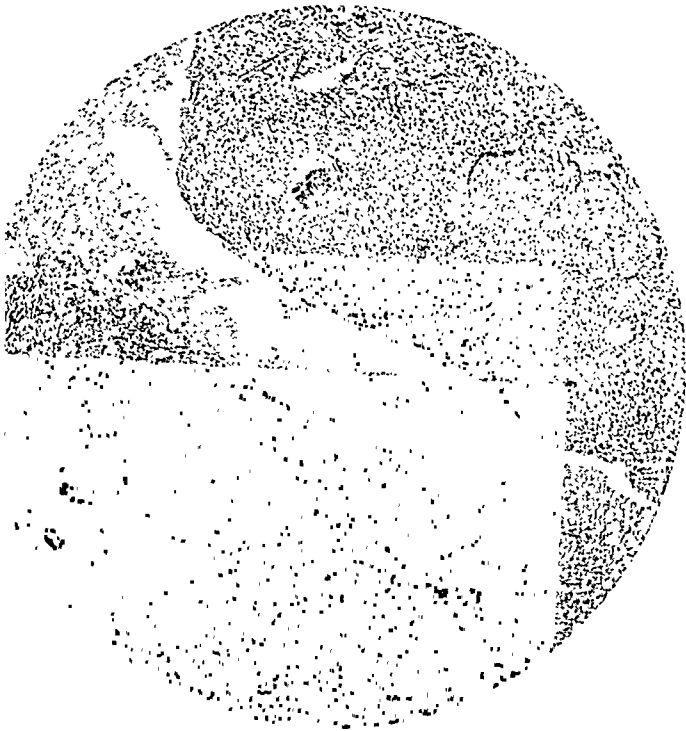


Fig. 1. *Case 2*.—Photomicrograph of the section from the uterine curettings. Note the caseated area and many giant cells.  $\times 150$ .

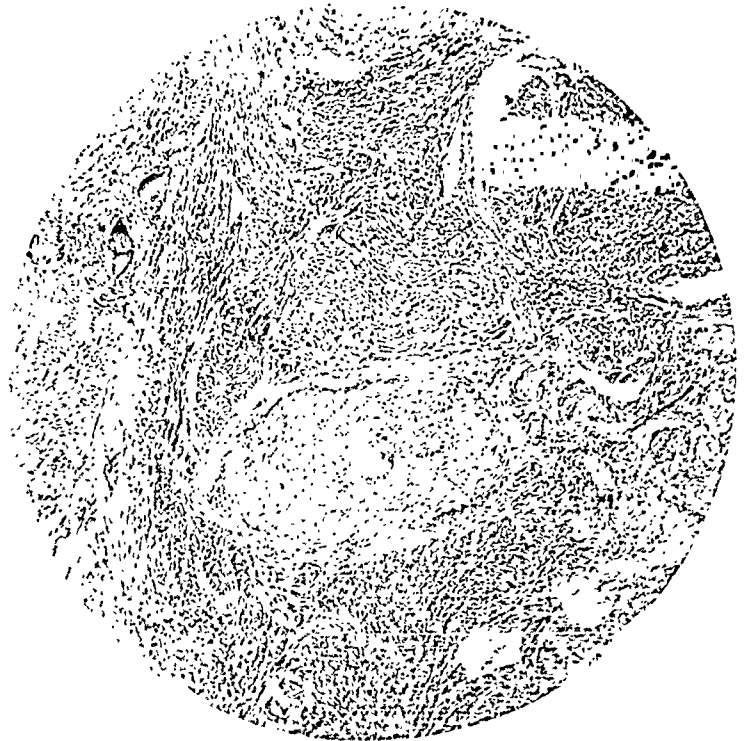


Fig. 4. *Case 2*. Photomicrograph of the section taken from the cervical portion of the uterus. Note the caseation and a number of giant cells.

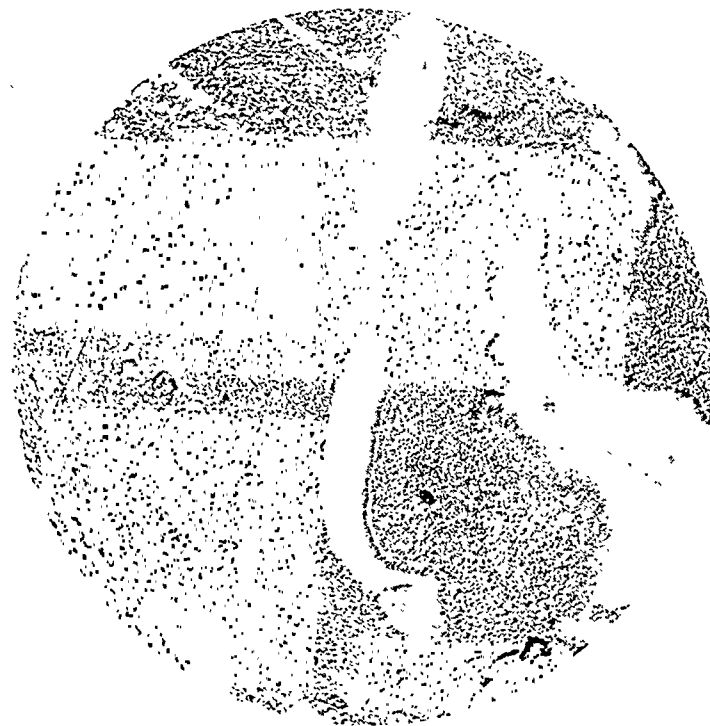


Fig. 3. *Case 2*.—Photomicrograph of the section from a piece of the endometrium showing the typical tuberculous nature of the lesion.  $\times 150$ .



Fig. 5. *Case 3*.—Photograph of the uterus and its adnexa. The thick walled abscess cavity is seen on the left of the uterus. Uterus has been cut open to show the irregular masses which are protruding from the cavity of the uterus. Note the caseating areas in the tubes and the ovaries.





Fig. 6. *Case 3.*—Low power photomicrograph showing the condition of the uterine endometrium. Necrotic areas and granulation tissue could only be seen. Numerous giant cells are seen which appear as curved black specks in the picture.  $\times 30$ .



Fig. 7. *Case 3.* Photomicrograph of the section from the wall of the abscess cavity showing necrosis and many giant cells in the field.  $\times 150$ .

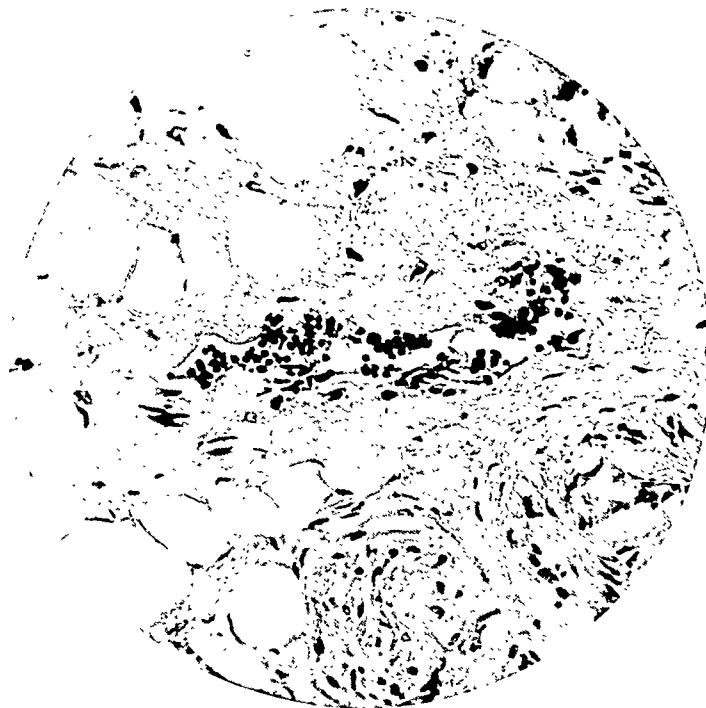


Fig. 8. *Case 3.*—Photomicrograph of the section from the wall of the abscess cavity showing Gram-positive cocci within a small capillary.  $\times 400$ .

PLATE XIV



Fig. 2. *Case 2.*—Coloured diagram showing the naked-eye appearance of the uterus, tubes and the left ovary. Caseations and tubercles are seen on the tubes and the ovary. The uterine cavity is filled with nodular masses and hæmorrhages. Within the cervix there is a hæmorrhagic area on the left which was due to instrumentation.



specimens numbering 3,744 collected within the period of 20 years, 1920 to 1940, tuberculosis accounts for 26 cases, i.e., 0.69 per cent. From unselected post-mortem figures in females only, collected over the same period, tuberculosis of the genital organs occurred in six cases, i.e., 1.1 per cent. Out of the total autopsies of 430 cases in females, in 67 cases death was due to tuberculosis and in these more than 8 per cent of cases showed secondary infection of the genital tract.

Finlaison (1936) quoted figures from different authors which showed that in unselected autopsies in females 1.5 per cent to 3 per cent cases showed tuberculosis lesions in the genital tract and in cases where death was due to tuberculosis, the figures were from 5 to 12.6 per cent.

The main complaints in our 26 cases were bleeding, tumour and leucorrhœic discharge, which are very similar to the symptomatology of a malignant neoplasm. Without biopsy the diagnosis between tuberculous infection and carcinoma is difficult. The evidence of a tuberculous lesion anywhere else might give a clue. In any case, whether the tuberculous lesion is a primary or a secondary one, the question must remain as a conjecture, in the absence of an autopsy. A hidden primary focus might produce tuberculosis of the genital tract by hæmatogenous spread.

From table II, it will be seen that most of the cases occurred between the ages of 20 and 40. It is to be noted that this is the age when the incidence of pulmonary tuberculosis is highest. The commonest age for uterine carcinoma is above 40. So it seems reasonable to think that, in any case where there is any suspicion of uterine carcinoma below the age of 40, the question of tuberculosis should be kept in view. In case 2 the spread was evidently through direct continuity, originating from the ileo-colic site. In this case, the body of the uterus showed large caseating areas at the opening of the tubes on both sides, and thus most probably the uterine body substance and the cervical portion got very extensively infiltrated.

In case 3, obviously the tuberculous lesion of the genital tract is a part of the generalized infection, mode of spread being hæmatogenous, the primary focus being in the lungs. In this case the sites of the tubal openings in the uterus did not show any tuberculous lesion. The damage of the genitals here was more than in case 2, which is natural because of the difference of modes of spread of the infection, the former by direct continuity and the latter by the blood stream. In case 3, streptococcus was isolated from the pus and was demonstrated in the tissue. It seems probable that the streptococcus appeared as a secondary invader, the primary mischief being done by the mycobacterium tuberculosis. Although we did not investigate the pus for the presence of acid-fast bacilli, the

(Continued at foot of next column)

## CACHEXIA HYPOPHYSIO-PRIVA (SIMMONDS' DISEASE)

(DESCRIBING A CASE CURED UNDER TREATMENT)

By B. B. BHATIA, M.D., M.R.C.P. (Lond.)

Physician to King George's Hospital, Lucknow

IN 1914, 1916, and 1919, Morris Simmonds of Hamburg described cases of cachexia of hypophyseal origin, with fatal termination, associated with septic puerperal infarction of the anterior lobe of the pituitary gland. Since then several cases of this disease have been reported in the medical literature and Lichtwitz in 1922 employed the name of Simmonds' disease to them. Up to 1928, Stocks (1930) had collected 34 cases, 4 years later in 1932 Calder had added 36 more.

This disease is more common in the female sex and more cases tend to occur in the second half of life. In most cases the lesion in the pituitary gland is a sclerosing atrophy, but cases

(Continued from previous column)

primary rôle of the mycobacteria is evident. In case 4, the infection of the genitalia must have been blood-borne from the primary pulmonary tuberculosis. She died of meningitis which probably was tuberculous in nature although the exact details were not available. In case 5 the peri-acinal and peri-lobular distribution of the tuberculous lesions would lead one to conclude that the dissemination of the disease was through the blood. Although no other focus of tuberculosis could be found, the primary nature of the involvement of the Bartholin gland is difficult to accept because of the hæmatogenous nature of the spread.

### Summary and conclusions

(1) Three thousand seven hundred and forty-four unselected gynæcological biopsy specimens and 430 unselected autopsies in females, collected between 1920 to 1940, were studied for evidence of tuberculous lesions in the genital tract.

(2) From the biopsy materials the incidence of tuberculosis of the genitalia was found to be 0.69 per cent. From the post-mortem figures the incidence was 8.9 per cent in unselected deaths in females, and where death occurred from tuberculosis the percentage was found to be 1.1.

(3) Five cases of genital tuberculosis in females are described in detail.

(4) Difficulties of diagnosis between uterine carcinoma and tuberculosis are stressed.

Our thanks are due to Lieut.-Colonel J. C. De, I.M.S., Superintendent, Medical College Hospital, Calcutta, for the case records and to the staff of the Department of Pathology, Medical College, Calcutta, for their help.

### REFERENCE

FINLAISON, F. H. (1936). *J. Obstet. and Gyn. Brit. Empire*, 43, 473.

of septic infarction, inflammation, tuberculous or syphilitic granuloma, tumour and cystic growth have also been reported. In some cases atrophy in other endocrine glands has also been noted, and it is difficult, if not impossible, to differentiate such cases from those of pluriglandular deficiency. Some doubt on the pituitary origin of these cases was thrown by Urechia and Elekes (1925). They believed that the primary change in this disease was in the tuber cinerium, and for this reason they labelled their cases *cachexia tuberienne*. Zondek (1935) has also reported some cases of this disease associated with tumour in the region of the infundibulum and tuber cinerium. In view of the fact that in almost every case of this disease, evidence of deficiency of several endocrine glands is manifested, it seems natural to assume that the lesion must be in some place from where the function of many endocrine glands is controlled. Recent researches have shown that such a place is the anterior lobe of the pituitary gland, which has several hormones that control the activity of other endocrine glands, such as the gonadotropic hormones for the sex gland, thyrotropic hormone for the thyroid, adreno-tropic for the supra-renal, pancreato-tropic for the pancreas, and so forth. It is for this reason that the anterior pituitary is rightly regarded as the 'conductor of the endocrine orchestra' and is in all probability the seat of lesion in this disease. It is possible that in some cases the lesion may have spread to the adjacent portion of the tuber cinerium.

The following case, which was typical of this disease and made recovery under treatment, seems worthy of record:—

Mahadeva, aged 26, farmer from Gonda District, U. P., was admitted under me at the King George's Hospital on the 9th January, 1940, with the following complaints:—

- (1) Progressive emaciation for last six months.
- (2) Great weakness and lethargy.
- (3) Headache.
- (4) Occasional attacks of pain in abdomen, followed by diarrhoea.
- (5) Nocturnal blindness.

In the past, he had suffered from malaria and dysentery about 3 years ago, and since then he had occasional dyspepsia and sexual weakness.

On examination, the patient looked extremely emaciated, anæmic, and toxic with typical senile facies. His weight on admission was 76 lb. The skin was dry, with some patches of pigmentation on the hands, forearms and feet (pellagroid type). There was loss of elasticity in the skin because, when a fold was raised between two fingers, it remained standing. There was loss of hair all over the body, but particularly well marked in the axilla, pubic region and beard area. A few days after his stay in the hospital he developed some oedema on his feet. Thus, briefly, his condition on admission was as follows (figure 1):—

Weight .. .. 76 pounds.

Cardio-vascular system Pulse 60 per minute, regular; blood pressure 80/60; heart nothing abnormal.

Respiratory system .. Nothing abnormal.

Kidneys .. .. Urine scanty, average daily 8 ounces, no sugar, albumin or casts.

Alimentary system ..	Hypochlorhydria, mild diarrhoea, with increase in total amount of fat 38 per cent (mostly unsplit).
Nervous system ..	Fundi, nothing abnormal, visual fields normal, deep reflexes absent.
X-ray of skull ..	Sella turcica rather small.
Total red cells ..	2,900,000 per c.mm.
Total leucocytes ..	8,160 per c.mm.
Hæmoglobin ..	58 per cent.
General blood picture	Fair number of macrocytes.
Fasting blood sugar ..	60 mgm. per 100 c.cm.
Blood calcium ..	8 mgm. per 100 c.cm.
Blood protein ..	Albumin 3.2, globulin 1.5.
Basal metabolism rate	-26 per cent.
Wassermann reaction	Completely negative.



Fig. 1.—Patient on admission.

From the above clinical picture it was clear that he had evidence of deficiency of many endocrine glands, for instance, dry skin, falling of the hair, reduced (-26) B.M.R. slow heart rate and lethargy, indicated deficiency of the thyroid gland; asthenia, pigmentation, low blood pressure, low blood sugar and toxæmia indicated deficiency of the supra-renal (cortical and medullary); low blood calcium showed deficiency of the parathyroid. Disappearance of secondary sex characters (hair over the beard and pubic region) and sexual weakness indicated deficiency of sex glands. He was thus diagnosed as a case of *cachexia hypophysio-priva*. The alternative diagnosis was that of sprue or chronic pancreatitis, but there was no stomatitis or history of residence near the seaside. Although the stools were fatty, they were not bulky or frothy. Moreover, the increase in total fat was due to neutral fats and not split fats, as occurs in sprue. The possibility of chronic pancreatitis was thought of, but except the character of the stools, there was nothing in favour of this diagnosis. However, for about 2 months he was treated on symptomatic lines, with diet, rest in bed, hydrochloric acid, liver extracts, iron, calcium, marmite and intestinal astringents, but without the least improvement in his general

condition which on the 11th of March was as follows :—

Weight ..	80 pounds.	General appearance same as on admission.
Cardio-vascular system	Pulse 60/70, regular; blood pressure 85/60.	
Kidneys ..	Urine 8 to 12 ounces per day.	
Nervous system	Deep reflexes absent. Fundi clear.	
Total red cells	3,200,000 per c.mm.	
Hæmoglobin	76 per cent.	
Fasting blood sugar	65 mgm. per 100 c.cm.	
Blood calcium	8.5 mgm. per 100 c.cm.	

From this date onwards, he was given a few intravenous injections of glucose with insulin and was then put on antuitrin 'S' one c.cm. (100 rat units) on every alternate day. After about a month of this treatment, he began to show some improvement. The antuitrin 'S' injections were then given twice weekly. Hydrochloric acid by mouth and liver extract were continued for some time, but later on were given up. After 3 months of treatment, he was so much improved that it was difficult to recognize him. The steady improvement was maintained, even when injections of antuitrin 'S' and all other treatment were stopped.

Thus his condition two months after the cessation of antuitrin 'S' treatment was as follows (figure 2):—

Weight ..	122 pounds.	
General appearance ..	Vastly changed from the time of admission, skin was now smooth—pigmentation had disappeared, hair had grown in axilla and pubic region. Senile appearance had gone, there was no lethargy.	
Cardio-vascular system	Pulse 80 per minute, regular; blood pressure 120/75.	
Kidneys ..	Quantity of urine from few ounces per day had increased to 7 or 8 pints, specific gravity 1005. No sugar (diabetes insipidus).	
Alimentary system ..	One or two well formed stools per day. Total amount of fat 24 per cent. Acidity of the stomach within normal limits.	
Nervous system	All the deep reflexes were now present and fairly brisk.	
Total red cells	4,900,000 per c.mm.	
Hæmoglobin	95 per cent.	
Basal metabolism rate	+7.	
Blood sugar	10 mgm. per 100 c.cm.	
Blood calcium	11 mgm. per 100 c.cm.	

However, with this marked improvement all round, one new symptom developed which worried the patient very much, and that was a great increase in the frequency and quantity of his urine. This was however controllable with an injection of 0.5 c.cm. pitressin, given hypodermically once a day.

#### Discussion

The clinical picture of this case was so similar to the description of cachexia hypophysio-priva given in Zondek's book (1935) that it left no doubt in my mind, as regards the diagnosis, which was further proved by the therapeutic

test. But the actual nature of the lesion in the pituitary gland remained obscure; obviously it was not a tumour, as that would have produced ballooning or deformity of the sella turcica, and there would have been some evidence of pressure on the optic tracts. It was not a syphilitic granuloma, as the Wassermann reaction was completely negative. The possibility of tuberculous granuloma was excluded by the absence of any other tuberculous lesions in the body.



Fig. 2.—Same patient after ten weeks of antuitrin 'S' treatment.

Was it then an early atrophy or subacute inflammation, which improved under treatment, and, if so, in which way was antuitrin 'S' useful? These are some of the questions which are difficult to answer, in the present state of our knowledge. Several recoveries in cases of Simmonds' disease have been previously reported from the use of antuitrin 'S', notably by Hicks and Hone (1935), Dunn (1936), Herman (1936) and Baltzan (1937), but as far as I am aware, none of these reporters have explained how antuitrin 'S' works in these cases.

The appearance of diabetes insipidus in this case during the course of treatment would mean that the lesion, whatever its nature might have been, improved in the anterior part of the pituitary gland, but extended to the posterior part or else that both the parts were simultaneously involved, but the symptoms caused by the deficiency of the posterior lobe were masked by the simultaneous involvement of the anterior lobe. Cases of diabetes insipidus are known to have been relieved of their symptoms by the occurrence of thyroid deficiency (myxœdema). In this case, there was sufficient evidence of thyroid deficiency and that might have been responsible for masking the presence of diabetes insipidus, and, when the thyroid deficiency improved under treatment, diabetes insipidus began to show itself. If it is so, it would mean that antuitrin 'S' had some specific action in stimulating the functional activity of the anterior lobe. That could have been conceived of antuitrin 'S' was

(Continued at foot of next page)

## SCARS AND OPACITIES OF THE CORNEA AND THEIR TREATMENT

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IN our country, corneal scars and opacities are common. This is especially so in the crowded streets of big cities. The large majority of the partially blinded and a considerable proportion of the totally blinded are suffering from this ocular affection. The important causes of this group of ocular affections in our country are ophthalmia-neonatorum, neglected conjunctivitis and corneal ulcers, smallpox, irritant drugs, trachoma, and keratomalacia.

These scars and opacities may be due either to the primary affection of the cornea itself (e.g., primary ulcer of the cornea, perforating or penetrating injury, or injury to the cornea by a foreign body or irritant drugs) or to its secondary affection from the spread of an infective or inflammatory process (e.g., neglected acute or chronic conjunctivitis, trachoma, glaucoma, scleritis, episcleritis, cyclitis, and iridocyclitis), a growth from the other parts of the eye (e.g., pterygium), or the result of a specific infective process of the system (e.g.,

(Continued from previous page)

a preparation which represented the various hormones of the anterior lobe, but as it only contains the gonadotropic hormones, like those obtained from the urine of pregnancy, the improvement is hard to explain. I would have liked to give this treatment a trial in cases of marasmus of unknown ætiology occurring in early childhood, if I had a good case in the wards. Except in difference in age, the clinical pictures of the cases of these two diseases very closely resembles each other and it would certainly be worth while to give antuitrin 'S' treatment a trial in marasmus.

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syphilis, tuberculosis, leprosy, smallpox, chicken pox, cholera, and rarely influenza, cerebro-spinal meningitis, malaria, and kala-azar), deficiency diseases (e.g., keratomalacia), senile and other degenerative conditions (e.g., arcus senilis, axial degeneration of the cornea, band-shaped opacity of the cornea, etc.), neurotrophic disorders (e.g., various forms of herpetic keratitis and lesion of the 5th nerve), or of the spread of certain skin conditions (e.g., rosacea, acne).

Again, such rare conditions as metabolic (e.g., keratitis in gout, sclerosing keratitis in diabetes, central indolent ulcer of the cornea in cachectic conditions in children) and endocrine (e.g., corneal grey spots in myxœdema) disorders, desiccation, exposure, and irritation (e.g., keratitis sicca, keratitis lagophthalmos, in trichiasis, and ectropion of the lids, etc.), pigmentations of the cornea (e.g., metallic pigmentations of the cornea, melanosis of the cornea, and blood staining of the cornea), and congenital conditions (e.g., in congenital leucomata, congenital staphyloma, keratoconus and embryotoxis) may be the cause of corneal scars and opacities.

Before going into the discussion of the treatment of scars and opacities of the cornea, some important facts about the structure and function of the cornea and its pathological variations should be borne in mind.

1. It is an avascular structure and its nourishment depends mainly on dialysis from the periphery. Hence its metabolic process is sluggish and its affection tends to be chronic.

2. Its function depends mainly on its transparency and any slight injury to its tissue may affect this transparency.

3. The extreme sensibility of its epithelium and the imperviousness of its superficial cells to all toxins, except to the gonococcus and diphtheria bacillus, and probably to the pneumococcus are its natural protections.

4. Its epithelium has wonderful powers of regeneration. Therefore any damage of the corneal tissue up to the limit of the epithelium is not of much consequence.

5. Its epithelium is continuous with the epithelium of the conjunctiva; hence it is not difficult to see how the affection of the conjunctiva may also affect the cornea.

6. Its endothelium, like the external continuity of its epithelium with the conjunctiva, has also continuity with the uveal tract; therefore an affection of the uveal tract may affect the cornea secondarily through its endothelium.

7. The sclerotic and the cornea are structurally continuous with each other, both forming the external tunic of the eye; hence any affection of the sclerotic may also spread to the cornea.

8. The Bowman's membrane has little power of resistance and is easily affected. When once destroyed, it never regenerates; therefore some degree of permanent opacity is sure to result after it has been affected.



9. The corneal lamellæ in the substantia propria when destroyed is not reformed, unless the defect is superficial, in which case the loss of tissue is replaced by epithelial growth.

10. Descemet's membrane, unlike Bowman's membrane and the substantia propria, is a highly resistant structure. Therefore it is a great check to external infective processes entering the eye.

11. In superficial injuries of the cornea, the defect is recovered by growth of the epithelium and no opacity of the cornea results.

12. When the injury of the cornea is deeper, regeneration of the epithelium together with the formation of new blood vessels from the periphery result in the growth of connective tissue which gives rise to corneal opacities or scars.

13. If the loss of corneal tissue is extensive and scar tissue formation deficient, the thin cornea is likely to bulge out owing to the presence of the intra-ocular pressure, resulting in an ectasia of the cornea.

14. When the whole thickness of the cornea, except Descemet's membrane is destroyed the latter, being very resistant, may still persist but bulge forward as a result of intra-ocular pressure and thus form a keratocele.

15. In perforating wounds or in perforating ulcer of the cornea, if there is loss of aqueous, the iris may come in contact with the cornea and slowly get attached to it by fibrinous exudate and thus form an anterior synechia and adherent leucoma.

16. In a perforating injury through the centre of the cornea with the escape of aqueous and injury of the lens capsule, the lens capsule may form a synechia with the cornea.

17. If any corneal scar is extensive, incarcerated with the iris and ectasia, anterior staphyloma is produced, which may be partial or total, depending on the extent of the prolapsed iris tissue; when a part of the iris tissue gets entangled in the corneal perforation, a newly formed growth of the iris tissue may form in the scar tissue resulting in the pigment formation of the adherent leucoma.

18. The entangled iris tissue in the perforated area, or the torn capsule of the lens in perforating injuries may keep the opening partially open, so that the aqueous may slowly escape through it, forming a fistula which looks like a black dot on the cornea and which area is stained by fluorescein.

19. If the iris is carried not only into the wound but protrudes through it, the condition is called prolapse of the iris.

20. In advanced cases of injuries to the cornea, penetrating or otherwise, where the lens or especially the vitreous may escape forming a flat opacity of the whole cornea, the condition is called phthisis bulbi anterior. Owing to the sudden lowering of tension in some other cases, there may be choroidal hæmorrhage, and the vitreous, retina and choroid may come out with the shrinkage of the whole eyeball, a con-

dition called the phthisis bulbi. Phthisis bulbi may also form as a result of cyclitis.

Left to themselves, scars or opacities of the cornea tend to clear up, especially in younger individuals and when the lesion is superficial, as already explained. Hence age is a great factor in regard to prognosis of vision after corneal affections. Besides having a tendency to clear up, such scars may give rise to pigmentary or other degenerative changes. In extensive scar formation, glaucoma may result with associated degenerative changes in the ciliary body, choroid, retina, and vitreous.

### *Treatment*

#### *1. Prophylactic or preventive*

(a) Mechanical protection of the eye by goggles against accidental injuries of the cornea.

(b) Vaccination against smallpox.

(c) Introduction of vitamins in diet to prevent keratomalacia.

(d) Prophylactic or preventive treatment for non-perforating wounds or ulcers against perforation where the prognosis in regard to vision may be grave.

#### *2. Medicinal*

Medicinal treatment may be resorted to in more-or-less recent and superficial opacities of the cornea and where there is not much involvement of the neighbouring structures.

Drugs used for the absorption of the corneal scars are mostly those which improve the local circulation. Such drugs are hydrargyri oxidum flavum, dionin, calomel, noviform, jequirity, quinine bisulphate, benzyl-cinnamic-ester, etc., instillation of oily drops, e.g., paroleine may be useful in keratitis sicca.

In addition to the local use of drugs non-specific protein therapy in the shape of milk injections may give good results.

Besides, specific therapy in syphilitic and leprotic cases, as well as tuberculin in tuberculous cases when not too late, may surprisingly clear up corneal opacities. Also local and internal administration of vitamin A is useful in cases of keratomalacia and superficial punctate keratitis.

#### *3. Physical*

Physical methods of treatment are used with the idea of producing locally more lymph and peripherally more blood circulation; these are finger massage, electric vibro massage, ultra-violet ray, etc.

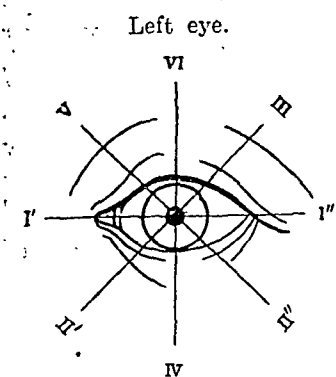
The results of such methods of treatment are very seldom satisfactory.

#### *4. Operative treatment*

Satisfactory results are mostly found by operative treatment.

(A) *Optical iridectomy.* In central and deep scars, where there is sufficient clear cornea left at the periphery, optical iridectomy should be done.

The sites of election of this operation should be as shown in the following diagram :—



I' = the best.

VI = the worst (because the coloboma is covered by the lid and is useless for vision).

Optical iridectomy should be as narrow as possible, so that the dazzling effect of light is avoided and stenopic vision obtained. It should not extend to the ciliary border.

(B) *Tattooing of the cornea.* The reasons for tattooing of the cornea are two, viz, (i) optic, and (ii) cosmetic.

(i) A nebula may make vision more troublesome than a thicker opacity, e.g., macula or leucoma, owing to its dispersive action on light. By tattooing, this dispersive action is stopped and vision becomes more distinct. The optical effect is seldom obtained by tattooing alone especially if the tattooed area covers a large part of the pupillary aperture, unless later on an optical iridectomy is performed.

(ii) The cosmetic effect is obtained by tattooing the thick opacities. If the thick opacity covers the greater part or the whole of the cornea, the middle portion should be tattooed; the central area being thus made darker than the periphery; the pupil is simulated.

There are two methods of tattooing, viz, (i) chemical, where the opaque cornea is dyed by chemicals, and (ii) the introduction of colouring agents directly into the corneal tissue.

(i) Of the chemicals, various solutions have been tried, e.g., gold chloride, platinum chloride, silver salts, iron sulphate and tannin. Of these, platinum is more suitable in our country because of its forming a dense black plaque with a metallic lustre.

The epithelium of the cornea is first scraped off. The chemical solution is allowed to impregnate the subjacent tissue over which the epithelium again grows.

(ii) In the method of introduction of a colouring pigment directly into the corneal tissue, lamp black, candle soot, ink or gold dust have been tried.

Chemical agents give much better results.

Corneal opacities may also be cleverly covered by coloured contact glass, the glass being coloured on the area covering the opacities.

(C) *Keratoplasty or corneal grafting.* This is the ideal operation for corneal scars, but, as it is an extremely difficult operation which should be done by experts only, we shall not give much space to its discussion.

By grafting a clear cornea into the area from where the scar has been removed, the whole cornea looks practically free from any opacity,

and if the result of the operation is successful there is consequently a considerable improvement of vision.

Three methods of performing the operation have been described, total keratoplasty, superficial lamellar keratoplasty, and penetrating circumscribed keratoplasty; of these the last-named operation gives the best result. In it a small disc of the opaque cornea is removed with a trephine. A graft of the same size is similarly removed from the clear cornea of the eye of a recently dead person or of a recently enucleated eye in which the cornea remains clear. The graft is kept in place by a bridged double suture which extends over it from the conjunctival limbus on either side.

In total keratoplasty, where the whole cornea is transplanted, the after-results are very unsatisfactory. Such a graft gradually becomes opaque and the iris gets adhered to it and either secondary glaucoma results or the eye is lost due to the formation of phthisis bulbi. This operation has been given up now.

In superficial lamellar keratoplasty, a circumscribed superficial lamella of an opaque cornea is removed and a lamella of transparent cornea is grafted on it. The remote results in most cases are unsatisfactory.

In Europe, both on the Continent and in England, very good results have been obtained by keratoplasty. In our country too, similar results of this operation have been obtained by some eye surgeons (Kirwan, 1935).

#### *Operative treatment of corneal scars with complications*

(a) In complete perforation of the cornea.

(i) With prolapse of the iris tissue :—Free excision of the prolapsed tissue should be done so that the formation of a staphyloma later on may be prevented and if the wound gapes it should be closed with a conjunctival flap or a corneal suturing and pressure bandaging done.

(ii) If a fistula forms without any prolapse of iris tissue, repeated paracentesis should be done to counteract the intra-ocular tension and thereby help healing and then the wound should be closed with a conjunctival flap. If this fails, cauterization or scraping of the edges of the fistula with a sharp knife, and then suturing the cornea or covering it by means of a conjunctival flap should be tried.

(b) In cases where a staphyloma develops.

(i) When partial :—The adherent iris should be cut with a knife through the anterior chamber or iridectomy may be done on either side of the incarcerated portion of the iris.

If the partial staphyloma be small, it should be split up with a knife and then excised with forceps and then the divided portions sutured or covered by means of a conjunctival flap.

(ii) When total and extensive, enucleation of the eyeball should be done.

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## NON-SPECIFIC ULCERS OF THE ALIMENTARY TRACT\*

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IN the course of a large number of autopsies, a variety of ulcers are seen in the alimentary tract that do not have the characteristic gross appearance of any known specific ulcer. Bacteriological examinations for the determination of causal organisms fail to indicate an infection by any of the usual agents. Chemical examination does not show the presence of any poison, and histological examination of the ulcerated or inflamed areas fails to show any characteristic cell picture.

There is another group of autopsies, in which the clinical history is very strongly suggestive of a specific lesion, but the autopsy findings are very variable and quite unlike the changes usually noted with the specific infections. This group is of great clinical importance from the point of view of the treatment of such cases.

The third group, which will not be considered in detail in this paper, is the group of non-specific ulcers caused by obvious pathological processes like embolism, chronic obstruction, or a neighbouring acute inflammation like appendicitis or salpingo-oophoritis. Non-specific ulcers may also occur as a result of chronic congestion and oedema of the intestine, either in atrophic cirrhosis of the liver or congestive cardiac failure. Although these last are of very little significance from the point of view of pathologists, the symptoms of diarrhoea and blood and mucus in the stool sometimes continue for several weeks and in a few cases dominate the clinical picture at the time of admission to the hospital. In cases of congestive failure with obvious auscultatory changes in the cardiac area, the secondary nature of these symptoms is easily recognized, but in cases where there are no valvular changes, and particularly in cases of cirrhosis of the liver, the diarrhoea and

blood and mucus have led the physician to suspect primary dysentery leading to nutritional oedema.

Non-specific ulcers of the alimentary canal, when considered in their strict pathological definition, thus form a very large and rather indeterminate group. Very often it is felt, that the failure to find a specific cause is more the result of the technical difficulties of investigation, than of a real non-specificity of the causal agent. Most of the workers in the autopsy room are familiar with the difficulties regarding the delay between the death and the autopsy, the difficulty of preventing contamination, the difficulty of a follow up by animal experiments, and the vagaries of serological diagnostic tests.

While the pathologist with his more rigid criteria oscillates between the two extremes of either accepting too many lesions as non-specific, because the specific cause could not be determined, or deliberately including all lesions in one or the other specific group with which the lesions had some similarity, the clinician definitely accepts the group of non-specific enterocolitis as a clinical entity with certain characteristic symptoms, signs, radiological findings and lines of treatment. Crohn *et al.* (1932) were the first to establish this disease entity.

The attention of the writer was first drawn to this group by the description of signs, symptoms, and the morbid changes in the colon, in a group of cases described as chronic non-specific non-ulcerative colitis, in a short article in the Leibig Anniversary volume. The cases are of a type often met with here, both in clinical practice and in the autopsy room. The patients are middle aged; they have a chronic diarrhoea, with occasional periods of passage of blood and mucus; there is a moderate anaemia, oedema round the ankles, and a hint of ascites. Repeated stool examinations fail to show any specific agents. In a few cases on which autopsies are performed, the major change is in the rectum and the ileum. The colon is very slightly if at all affected. The rectum often forms a thickened rigid tube, with irregular lumen and small fistulae running into the neighbouring connective tissue, only for a very short distance. The fistulae do not give rise to peritonitis or ischio-rectal cellulitis. The ileum shows a diffuse or patchy thinning of its walls. It is tempting to call such condition a variety of sprue, or bacillary dysentery. But most of the cases have had several lines of treatment for sprue and dysentery without any success. In the article mentioned above, a vaccine treatment had been described. The vaccine treatment will be referred to, in considering the bacteriology of this condition.

A number of articles have appeared recently in the surgical journals describing acute segmented inflammations of portions of alimentary canal, describing these as acute regional jejunitis, ileitis, or colitis. At the same time a series of similar cases were encountered in the autopsies

\*A paper read at the meeting of The Teaching Pathologists of Bombay in November 1940.

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room. These were studied in detail and form the chief material for this paper.

In going over the autopsy records of the previous years, a number of suggestive case reports were met with, but the descriptions of the condition of the small intestine and colon were not sufficiently clear as to the exact position and distribution of the lesions, and in many cases a diagnosis of chronic bacillary dysentery was put down. In cases with chronic symptoms, both the symptoms and the autopsy findings were exactly like the ones described above. A number of cases with fistulae and fibrosis of the rectum have also been recorded. But the diagnosis is not clearly set down. Gummatous inflammation of the rectum is considered to be the most probable condition. There is one museum specimen in which the diagnosis is left open.

As the acute condition was not recognized as a separate entity, there is no mention, and no detailed description of any lesions in the small intestine which can be construed to be regional enteritis.

Since 1937, the writer has been able to collect forty-four cases of non-specific inflammations of the alimentary canal. The distribution of the lesions was :—

	Acute	Chronic	Total
Œsophagus ..	8	5	13
Jejunum ..	3	0	3
Jejunum and ileum	4	? 1	5
Ileum ..	4	? 2	6
Mesenteric glands	4	..	4
Colon ..	6 plus ? 2	? 2	10
Rectum ..	3	7	10

Of the lesions included in this group, the inflammation of the œsophagus is not strictly speaking a part of the regional enteritis as a clinical group, but they can be included in the group of non-specific inflammations of the alimentary tract.

In the case of the colon and rectum, the writer does not feel satisfied that the number is really representative. This doubt is felt for two reasons. Two of the ulcers were associated with septic endometritis and one with ulcerative endocarditis. On the other hand, a large number of ulcers of the colon appeared to have the mixed characters of amœbic and bacillary dysentery, but no amœbæ could be found in the scrapings or sections and no bacilli of the lactose non-fermenting type could be obtained in cultures. These cases should have been included in the group. Still, because of the similarity with standard lesions, such ulcers have been definitely excluded from the group of non-specific ulcers. For this reason the group of regional colitis is not satisfactorily represented in this series.

The cases of chronic ileitis and jejunitis are also more interesting from the clinical viewpoint than as well-defined pathological entities.

#### *Ulcers of œsophagus*

Acute non-specific ulcers of the œsophagus were found mainly in the neighbourhood of the

tracheal bifurcation. In two cases they were multiple, in the rest single. The ulcers were longitudinal in one case; in the rest, they were transverse. In all cases they had raised edges infiltrated with blood. The bases were free from slough. Histologically, a moderate amount of leucocytic infiltration was considered to be a necessary condition for considering the ulcers as inflammatory. Lyall (1937), who had studied a series of such ulcers, considered that an aberrant gastric mucosa was found in a majority of these ulcers. In the present series aberrant gastric mucosa was found in only one ulcer. Lyall also found associated peptic ulcers in half his cases. In the present series there was no associated peptic ulcer. All these ulcers were found incidentally. It is not possible to say whether there were any clinical symptoms.

Chronic inflammations of the œsophagus were chiefly found in cases of ~~anæmia~~. Four were non-ulcerative in type, one was a chronic ulcer. Of these chronic conditions, four were found in females and one in a male. Definite symptoms of dysphagia were found in one; in two there was pain and vomiting and rapid wasting; in the other two, no clinical manifestations were noticed. In the case of chronic dysphagia, the lower half of the œsophagus was dilated in a fusiform shape, the walls and the mucous membrane were thickened, silvery grey in colour and thrown into irregular folds. The cardiac sphincter did not seem to be thickened, or ulcerated. The stomach was a little smaller. There was no ulceration or growth in the stomach. On section, the œsophagus showed a well-marked increase in the submucous connective tissue. The connective tissue was hyaline and showed small collections of mononuclear cells. There was no hyperplasia of the epithelium. The condition could not, therefore, be considered as precancerous.

The other three cases showed a thickened stiff œsophagus which was narrowed and tortuous rather than dilated. The stomach in all these cases also was free from peptic ulcers or growths.

The chronic ulcer was found to be just above the cardiac end; the edges were so much thickened as to suggest malignancy. The edges, though thickened, were not everted, but shelving towards the base. Sections showed non-specific chronic inflammatory granulation tissue. There were syphilitic manifestations in other organs.

#### *Acute jejunitis and ileitis*

The chief characteristic of these lesions is a segmental distribution and simultaneous involvement of all coats in the segment affected. On opening the peritoneum, portions of congested intestine are seen to alternate with portions of normal-looking intestine. Sometimes only one small length may show congestion. Seen at the

earlier stage, the appearance suggests a post-mortem artefact, but the presence of hæmorrhages on the serous coat, and usually also red, swollen mesenteric glands, suggest an enteric infection. Seen at a late stage—it seems to be a late stage—the massive congestion suggests infarction due to mesenteric thrombosis.

On opening the intestine, there is a well-marked hæmorrhagic infiltration, which may be in patches or diffuse, and the mucous membrane is necrotic in patches, which are raised up into everted, greenish folds, or round areas. Removal of mucous membrane and formation of undermined ulcers was considered to be against the condition being a non-specific inflammation.

The Peyer's patches were occasionally the seat of hæmorrhage, but did not show the primary swelling and ulceration, nor the pattern of dilated vessels converging towards them, seen so well in enteric infections.

The chronic lesions were not so distinctive. In four cases they consisted of punched out circular or transverse ulcers more in the jejunum than in the ileum. The ulcers did not show any tubercles at the edges, or on the serous coats. The white radiating lines in the serous coat, so characteristic of tuberculous ulcers were not present. Histological examination failed to show any tuberculomata. Strictures and hypertrophic thickening are described by several authors under a variety of names, but in this series no well-marked strictures or thickening were noticed.

The other chronic type of lesion was found in comparatively young persons, between the ages of 20 to 30 and in this group also females predominated over the males, 5 to 2; in these, symptoms of diarrhoea, wasting and anæmia were present in four. In two, operations were done for acute abdomen, although there was a history of pain in the abdomen for more than a month.

In these cases, portions of ileum showed a uniform thinning of all coats. The mucosa was covered with an excess of mucus over the thinner areas and while wiping away the mucus, fragments of mucosa were also dislodged. There was no congestion, but in the drainage area of the part one or two sentinel mesenteric glands were found, which were red with yellowish spots, but without any definite pus. Microscopic examination showed lymphadenitis with focal cloudy degeneration.

Although mesenteric glands have been mentioned separately in the table, they were not found as an isolated lesion, but had accompanied either acute or chronic enteritis.

#### *Regional colitis*

As explained previously, the number of cases included in this group is more probably too small than too large. In the acute group, only those cases are included in which there was either a simultaneous involvement of the colon and small intestine, or the primary condition of the colon

had given rise to other infective foci in which non-specific organisms were found.

While the lesions in the small intestine were similar to those described by other writers, the lesions in the colon were not of the standard type. The best description of the colon is given by Burke in describing a group of cases, as phlegmon of the colon. 'The involved portion varies from greyish red to purple in colour. The serosa is covered with fibrinous exudate. The bowel feels doughy'.

The lesions in the colon were either circular bands of necrosis with raised everted hæmorrhagic margins or round ulcers which differed from those of amœbic dysentery in being raised and everted with greyish coagulated sloughs. The edges were not undermined. The patchy distribution and the round shape, instead of serpiginous outline, were the points by which the ulcers were distinguished from those of bacillary dysentery.

The chronic regional colitis was of the standard type, segments of pelvic colon and rectum being chiefly involved, and thickening and fistula formation being the chief abnormality. Histology was characterized more by absence of any specific appearance than by the presence of a characteristic cell picture.

#### *Symptomatology*

The age distribution of regional enteritis is, as might be expected, quite wide. The fact that a large number of cases were less than 40 years of age is more probably due to the fact that the majority of autopsies are done on persons of this age group. At the same time this age distribution must be considered to have some significance, because several authors, such as Clark and Dixon, have found that the majority of surgical cases in the wards are also from this same age group. Sixty-three per cent of Clark's cases were less than 30, and 84 per cent less than 40 years of age.

In the present series the age distribution was as follows :—

0 to 10	..	..	..	2
11 to 20	..	..	..	4
21 to 40	..	..	..	17
41 onwards	..	..	..	8

There is no specially significant sex distribution of these lesions, although in the present series the females were comparatively more commonly affected.

Amongst the thirty-one cases, females were eight and males twenty-three; the symptoms and duration differed according to whether the condition was acute or chronic. In the acute cases, the duration was between 2 to 10 days, and the symptoms were either those of acute abdomen, with or without a lump, of food poisoning, or of enteric fever. In the acute cases laparotomy was done in three instances.

The following symptoms were met with in the chronic or recurrent cases :—

Pain in the abdomen ..	..	In all cases
Diarrhoea ..	..	" 15 "
Anæmia and wasting ..	..	" 9 "
Fistulæ ..	..	" 5 "

Radiological investigations were not carried out on any of these, but in the surgical and radiological journals, a tape-like appearance, narrowing and absence of haustrations are described as characteristic findings.

### *Ætiology*

In studying the ætiology, both positive and negative findings must be considered as of significance.

The ætiology of this condition must be considered under two heads: the bacteriological findings and the possible predisposing factors.

In every case of this type, scrapings from the ulcers were examined for amœbæ. Culture of the scrapings was done on Endo's medium. A culture from the heart-blood and from the bile was done on glucose broth. Triple Widal was done with blood from the jugular vein. Only when these cultures and serum reaction failed to show any of the specific organisms giving rise to inflammation of the intestine, were the cases included in this group.

The presence of tuberculous foci elsewhere was also looked for, and, if present, smears from the affected portions of the intestine and neighbouring lymph glands were examined for acid-fast bacilli. Mayo considered that an acid-fast bacillus allied to the bacillus of Johne's disease in cattle is an important causal agent, but, in the present series, if acid-fast bacilli were found, the cases were rejected as those of tuberculosis of the intestine.

The positive findings in this series were *Bacillus coli* from an accompanying meningeal exudate from one case of acute ileitis, and streptococci from two heart-bloods. In one case, there was erysipelas and in another the chronic fistula had given rise to a psoas abscess and pyæmia.

Among the predisposing factors, the presence of worms was given special attention, but it was found that the worms were not more frequent in this group than in the other routine autopsies. In the few cases in which round worms had produced severe disturbances, acute or chronic ileo-colitis was not prominently present.

Anæmia was present in a comparatively large number of cases, but it seemed more often the result than the cause of this condition.

Observations on the bacteriological findings in these cases are given by a large number of writers. Some are based on the appearance of bacteria in stained section which cannot be given much importance.

(Continued at foot of next column)

## NOTES ON COMMON SKIN DISEASES

### II. RINGWORM OF THE SCALP

By L. M. GHOSH, M.B. (Cal.), D.T.M. (L'pool)  
(From the School of Tropical Medicine, Calcutta)

RINGWORM of the scalp, tinea tonsurans, or tinea capitis, is essentially a disease of children. Children of the school-going age, between 5 and 15 years, are the worst sufferers, but adults may also contract the disease.

The disease is very contagious, the contagion spreading not only by direct contact with the

(Continued from previous column)

Examinations of the contents of resected loops by cultural examinations have given more reliable information. Monroe (1937) gives the following frequency with which various organisms are met with:—*Bacillus coli*, Bagen streptococci, hæmolytic coli, *Streptococcus viridans*, Salmonella, Gram-positive diplococci, *Bacillus alkaligenes*.

Bagen and his co-workers have investigated rectal swabs of a number of cases. Bagen has given much importance to a special variety of streptococcus. Like the work on streptococci by Rosenow this work has met with very adverse criticism by most writers.

A further detailed study of the coli-like organisms has been done with eosin-methylene-blue medium and a number of organisms have been also studied regarding their action on blood.

Christopher has studied a number of cases of ileo-colitis and is of opinion that amœbiasis plays an important rôle in the earlier stages of the condition. Later, the amœbæ disappear and that is why emetine or other anti-amœbic lines of treatment do not cause any improvement.

Felsen considers that bacillary dysentery may play a similar rôle and this writer examined the sera of such persons for agglutinins. The presence of anti-dysentery phages in the stools of these persons was considered by Felon, as evidence of the bacillary origin of this condition.

The bacteriology of this condition is thus in need of further detailed investigation.

### *Summary*

A description of non-specific inflammations of the alimentary canal based on forty-four cases is given. Thirteen were lesions of the œsophagus, and thirty-one of regional enteritis.

The characteristic pathological appearance of the lesions is described. The chief symptoms were of two types, according to whether the lesions were acute or chronic.

The ætiological factors have been reviewed.

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infected children, but also by the use of infected materials, such as hats, towels, hair brushes, combs, etc.

Another source of infection is infected domestic pets, e.g., cats or dogs.

#### Types

(1) Infection by a microsporon ringworm fungus—microsporiasis.

(2) Infection by a trichophyton ringworm fungus—trichophytosis.

(3) Infection by achorion ringworm fungus—favus.

(Favus requires special description and will be dealt with in a separate note.)

In India both microsporiasis and trichophytosis occur almost exclusively amongst the European, Anglo-Indian, Jew and Armenian children, and are found mostly in the hill station schools. Once the infection occurs the disease follows its natural course even when the infected children come down to the plains.

Trichophytosis is occasionally seen in the plains, though it is far more common in the hills.

Hair ringworm is not common in Indian children in the plains and *Trichophyton violaceum* is the only species we have so far encountered infecting Indian children.

**Signs and symptoms.**—Beyond occasional scratching there are hardly any symptoms at the early stage. Usually attention is drawn to it either by the appearance of small bald patches on the scalp or by the inflammation and ulceration due to a secondary infection.

Clinically, the two types of infection are often indistinguishable, without the aid of the microscope. When examined in a good light, one or several pinkish or whitish patches are seen on the scalp. The patches are scaly, the scales being heaped up conically around the hair follicles. The infected hairs become brittle and lustreless and present a dirty-white opaque appearance. The patches are covered with the short stumps of the hairs that have broken off, these project one-eighth to a quarter of an inch from the surface of the scalp; these stumps are bent in all directions owing to a loss of elasticity and are easily pulled out. In some cases of trichophytosis, the hairs break off at the level of the surface of the scalp, and the ends of the stump look like so many black dots at the orifices of the hair follicles. If left untreated these patches become permanently bald owing to the destruction of the hair root.

In advanced cases secondary infection by pyogenic cocci produces inflammation, ulceration, and baldness, due to scars of the healed ulcers.

**Examination of the hairs.**—If a few infected hairs (which are easily pulled out) are placed on a glass slide and a drop or two of chloroform is put on to them, the hairs turn chalky white. If treated with 40 per cent liquor potassi for about one hour and examined under the microscope ( $10 \times 1/6$ ), the infected hairs from

the bulb to about a quarter of an inch above the surface of the scalp will be seen ensheathed by spores. In microsporiasis, the spores are small and form a mosaic, whereas in trichophytosis the spores are arranged in chains like the beads of a necklace.

#### Differential diagnosis

(1) Alopecia areata.—The patch or patches when first noticed are completely bald the hairs having come out suddenly. In ringworm, the baldness comes slowly. In alopecia the patches are smooth and glossy, whereas in ringworm the surface is scaly and the patches are covered with short broken hairs. In doubtful cases microscopic examination for the ringworm fungus settles the diagnosis.

(2) Seborrhea.—The whole scalp is full of fine branny scales in seborrhea, whereas in ringworm the lesions occur in small patches from which short hairs point in different directions.

In seborrhea the hairs are healthy and do not break, nor come out easily when pulled.

(3) Psoriasis.—This is not common amongst children. The patches are thick and covered with silvery white scales. The hairs in the psoriatic patches are healthy.

#### Treatment and prophylaxis

For treatment it is not essential to determine the type of infection. A definite diagnosis of ringworm is enough and it must be remembered that all types of hair ringworm are highly contagious. Microsporon infection shows a tendency towards spontaneous cure when the patients attain puberty, and hence more drastic treatments should be avoided in the case of children nearing puberty, and grown-up girls suffering from microsporon infection should not have x-ray treatment unless absolutely necessary.

**Prophylaxis.**—The infected children should be kept away from others. Their associates, class mates and room mates should also be kept separate from both the infected children and from other healthy children, for four weeks, and during this period frequent and careful inspection should be made for any sign of infection, which should be confirmed by microscopic examination.

The hats, hair brushes, and combs that had been used by the infected children should be burnt, and towels, pillow covers, bed sheets and other linen in use should be frequently sterilized by boiling.

Careful search should be made for infection in pets (cats, dogs, birds, or even ponies).

The children should wear tight-fitting caps made of washable linen, and these caps should be either boiled twice every day (at least 6 caps are required for each individual), or destroyed by burning. The infected children must wear caps all the time and even at night throughout the course of treatment to prevent infected hair being spread throughout the house or school.



*Treatment.*—The hair should be cut short (*not shaved*), and kept short by frequent cropping throughout the whole course of treatment; the cut hair should be burnt immediately.

The infected hairs should be looked for and pulled out with the help of a pair of epilation forceps; the pull should be gentle and steady, otherwise the hairs will break. Great care, patience and a good deal of time is required every day, but this time is well spent.

The infected hairs look greyish or whitish; they lose their lustre and come out easily when pulled. The hairs thus pulled out should be burnt. At least one hour should be devoted every day for each patient.

The scalp is then washed, first with spirit soap (soft soap, 1 ounce and rectified spirit, 3 ounces) and warm water and then with cold water.

After the shampoo the infected patches in the scalp should be painted with the following paint :—

Thymol .. ..	10 gr.
Olei cinnamoni .. ..	10 minims
Liq. iodidi mitis .. ..	1 oz.

The following ointment is also useful :—

Acidi salicylici .. ..	20 gr.
Acidi benzoici .. ..	25 gr.
Olei coconut .. ..	3 drs.
Lanoline .. ..	1 dr.
Hard paraffin up to .. ..	1 oz.

Tincture of iodine may also be used.

This treatment should be continued for 6 to 8 weeks. After two months, the suspected hairs should be sent again for examination. Secondary infection with pyogenic cocci superimposed on the ringworm infection is common and in these cases the secondary infection should be treated first and completely cured, before the actual treatment for the ringworm infection is started. The treatment for the secondary infection is symptomatic, for example, fomentation with mild antiseptic lotions such as acriflavin lotion (1-5,000), or carbolic lotion (1-200) every four hours during the day and unguentum hydrargyri ammoniati dilutum 1-2 per cent applied at night. A lotion containing 2 per cent each of brilliant green and gentian violet made up with 10 per cent alcohol has been found useful.

Depilation by drugs administered internally or by application of local irritants is not advisable, except by those who have had considerable experience with the drugs, as serious results have followed inexperienced administration.

For refractory cases and for patients insisting on a rapid cure x-ray treatment may be given. The x-ray treatment must be given by an expert.

When the patients are declared cured of ringworm infection after several microscopic examinations, they should be given new hats, combs, hair brushes, etc.

## LABORATORY PROCEDURES, APPARATUS AND IMPROVIZATIONS

By C. L. PASRICHA

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Professor of Bacteriology

and others

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### (i) DESICCATION OF CULTURES, SERUM AND OTHER PRODUCTS

By C. L. PASRICHA

and

N. N. DAS

IN the recent medical literature, there has been an almost uninterrupted flow of papers describing new methods of desiccation, or introducing some modifications in old methods. It is not the purpose of this paper to describe a new method of desiccation, but to stress certain technical details and amplify certain procedures which it is hoped will be found useful in any method finally selected by a worker.

The method selected for desiccation of small amounts of material in the laboratory was Hartley's (1936) method. It is interesting to note that this method was adopted as the most suitable and practicable for the special purposes of preparing antitoxins and antisera in the dry stable condition for use as standards, and at the time of publication had been in use in Hartley's laboratories for 10 years. This fact alone speaks well for the method. Hartley records data showing the value of desiccation and that dried products remain stable for long periods, and when reconstituted by the addition of water or saline show little or no loss of biological activity. When it is remembered that Hartley had used such substances as antitoxic sera toxin and complement, which can be assayed with very great accuracy, the results obtained stress the practical importance and value of storing biological products in the desiccated state. Unfortunately, this method of storage of biological products has not been applied to any great extent in India, where for obvious reasons (great variations in temperature, difficulties in storage and transport) this method would be of particular value.

In a preliminary survey, several methods of desiccation were tried in the laboratory. Without going into the details of the comparative value of different methods, it can be stated that Hartley's method proved to be the easiest to work with and gave consistently good results. The desiccation in Hartley's method is affected by exposure of the fluid in ampoules to the action of phosphorus pentoxide, *in vacuo* in a desiccator. As, however, adequate supplies of phosphorus pentoxide were not available, gypsum (calcium sulphate), which is much

cheaper and available in large quantities, was used instead of phosphorus pentoxide. Calcium sulphate heated at 200°C. for 6 to 12 hours in a hot-air sterilizer is an efficient drying agent. Approximately 25 grammes of anhydrous gypsum is required for each 1 c.cm. of fluid material to be dried. An additional advantage of calcium sulphate is that it can be reactivated by heat. It is an advantage to connect the evacuated desiccator with a tower of 'activated' calcium sulphate so as to remove the moisture from the air subsequently admitted into the desiccator. As an additional precaution the desiccator is connected to an air-filtering device to remove any gross particles and bacterial contaminants from the air. This filtering device consists of two tall cylinders connected in series, the first cylinder contains a heavy oil covering a long column of glass beads (which serve to break up the air bubbles) through which the air passes and the second cylinder contains an arrangement by which the air goes through a Pasteur-Chamberland candle conveniently set up in a test-tube.

The drying in the desiccator is finally tested by means of a spark-coil detector for vacuum. This consists of primary and secondary coils with an interposed interrupter for direct current. With this apparatus the 220 (or 110) volt current from the main supply is raised to about 10,000 volts high frequency current. The terminal from the resonator coil, when applied on the exit tube of the desiccator proximal to the stop-cock, gives a violet spark in the tube if the desiccation is complete and the vacuum satisfactory. There will be no violet glow if there is any moisture (water vapour) still present in the desiccator. An apparatus for the detection of vacuum is listed in many catalogues of scientific apparatus, but as it was not available locally a search was made for some other apparatus which could be used for this purpose. The violet-ray apparatus available in many hospitals serves well as a vacuum detector. The resonator coil contained in the handle of the apparatus is fitted up with the metal electrode and this when brought to the surface of a tube properly vacuumized gives a violet glow inside the tube. This is an important step in the control of the proper state of desiccation and is valuable in testing the finished sealed ampoules.

Several bacterial cultures, agglutinating sera, bacterial toxins, group sera for blood groups, small-pox vaccine lymph, and cholera vaccine have been dried by this method, and when tested after reconstitution have shown no appreciable loss of activity. The method is comparatively simple and, when controlled by testing the finished products, gives satisfactory results. From the results obtained it appears that in addition to the preservation of certain cultures, toxins, and standard sera, this method will be particularly valuable in storing and distributing small-pox vaccine lymph and bacterial prophylactic vaccines.

### Summary

Attention is drawn to the value of desiccation of cultures and biological products in maintenance of activity and in storage and distribution. Hartley's method (using calcium sulphate instead of phosphorus pentoxide) proved to be the most convenient method for laboratory use.

Attention is also drawn to the importance of testing for vacuum both during the process of desiccation and of the finished sealed product. For this, an electrical device is necessary. A violet-ray apparatus, which is available in the majority of hospitals, can be used for this purpose.

### (ii) SIMPLIFIED TYPES OF ASBESTOS FILTERS

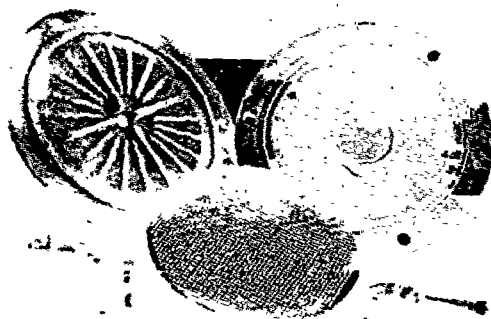
By C. L. PASRICHA

and

K. S. MALIK

Owing to the difficulty in obtaining, under war conditions, filters of the type using asbestos discs, it has been necessary to attempt their manufacture locally, and simplified forms which have been made have been found useful, efficient and cheap. A short description of a large and a smaller form is given below:—

A large type (photographs A and A<sub>1</sub>) takes asbestos discs of 5.5 inches in diameter giving a

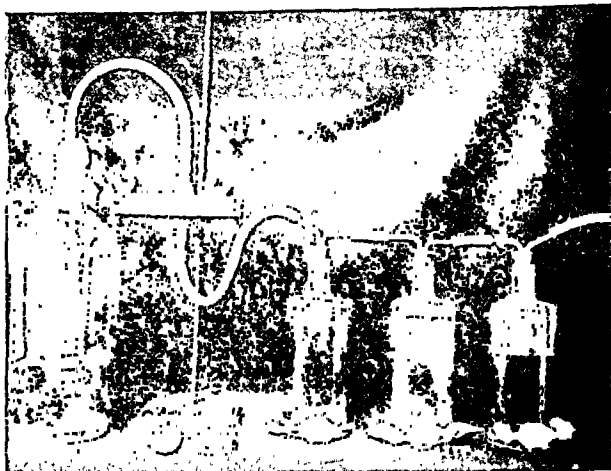


Photograph A. The larger type shown open. Behind the filter is the asbestos filtering disc and in front is the perforated metal plate.

filtering surface of 5 inches diameter. It consists of two parts held together by three nuts and bolts. There are no screw-in parts requiring washers, and thus there is no danger of leaks developing. This type is found most useful in the laboratory.

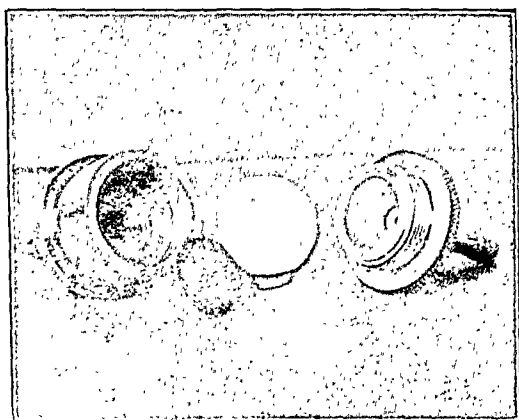
The smaller type (photographs B and B<sub>1</sub>) is designed to take filter discs of 1.5 inches in diameter giving a filtering surface of 1 inch diameter. It consists of two parts, one screwing into the other and the disc is held tightly between the two. A circular perforated metal plate (or a circular piece of gauze) is placed

below the asbestos disc to give the necessary support. Discs of the required size can be cut out with a punch of appropriate size. The small-sized filters are particularly useful and economical when small amounts or only samples of filtrates are required.



Photograph A. The larger type arranged to filter direct into a series of three screw-capped bottles.

For use both the small and large forms are fitted up with the necessary rubber tubings and placed in suitable metal containers for sterilization. The filtration is carried out under vacuum. Another advantage of the general set up, as shown in the photograph, is that neither



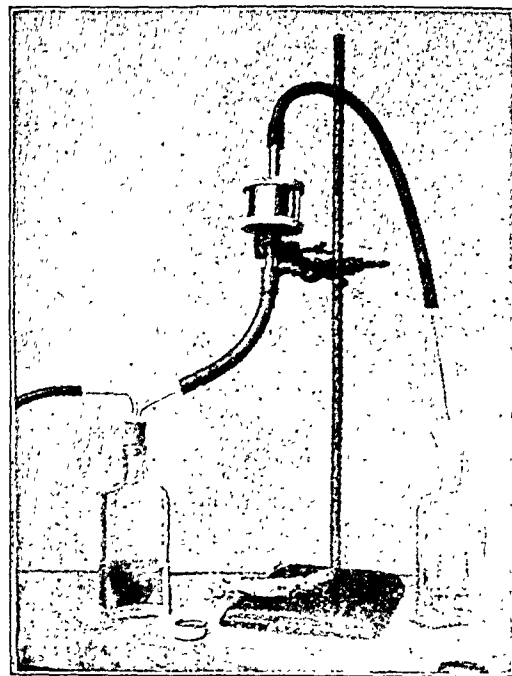
Photograph B. The smaller type consists of two sturdy parts one of which screws into the other. In the centre is the asbestos disc and by its side a circular piece of gauze which fits in a groove below the asbestos disc.

filtration flasks nor large rubber stoppers are necessary. Both these items are expensive.

Both forms are made of gun-metal and are heavily silver-plated or tinned. They were prepared to our design by Messrs. A. C. Dass, 36, Colootola Street, Calcutta, and cost Rs. 10 for the smaller type and Rs. 30 for the larger type.

### Summary

Two modified forms of filter using asbestos discs are described. They are simple of construction and have been made locally. They



Photograph B1. A convenient arrangement of filtering using the smaller type.

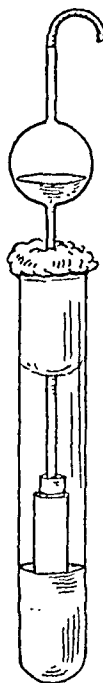
are inexpensive and are simple and efficient in use.

### (iii) A SIMPLE SUPPORT FOR MEMBRANES USED FOR FILTRATION

By C. L. PASRICHA

and

A. J. H. DEMONTE, I.M.D.



The accompanying diagram (drawn to one-third scale) illustrates a very simple support for membranes used for filtration. It consists of a Pasteur-Chamberland candle fitted on by means of a short piece of pressure rubber tubing to a glass tube on which a bulb has been blown. As the candle serves merely as a support for the collodion membrane, old discarded candles can be used for this purpose. The tubes with the attached candles are sterilized, and for use the candle is dipped into a standardized solution of nitro-cellulose. The filtration is carried out by suction and the filtrate collected in the bulb on the tube; from this it is removed by means of a capillary pipette.

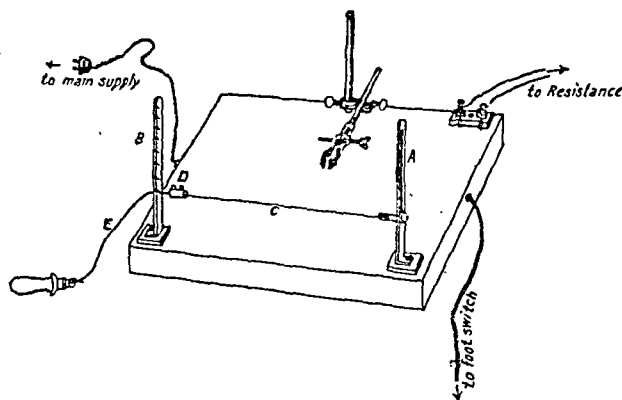
## (iv) A SIMPLE METHOD FOR OPENING GLASS AMPOULES AND CUTTING GLASS

By C. L. PASRICHA

Greene and Breazeale (1938) described an ingenious device for opening Keidal tubes. Their method consists of removing the upper portion of the Keidal tube by means of an electrically heated nichrome wire. This method was tried and gave satisfactory results. As the arrangement described and illustrated by these authors was somewhat inconvenient for our requirements certain modifications were introduced. These are :—

1. Instead of the 'on-off' switch on the apparatus board, a press switch controlled by the foot is employed. This allows of better control over the heating of the wire.

2. Instead of mounting the resistance on the board it is more convenient to have the resistance at a distance. A suitable rheostat is used, or a resistance can be prepared by winding nichrome wire on a length of fire-clay pipe suitably mounted on a board. The length of wire necessary to obtain the required resistance is found by trial.



3. Instead of short fixed terminal posts, tall brass pillars (A and B) are used and so arranged that the nichrome wire can be adjusted at any desired height. Pillar (A) contains a longitudinal opening through which the holder for the thin wire passes. This holder can be adjusted at any point by means of a nut and screw. Pillar (B) has a number of obliquely cut slits. The slits are sufficiently wide to allow the wire attached to the handle to be readily inserted. This arrangement allows of the use of the apparatus for cutting the neck of small ampoules or large-sized tubes or even bottles. It is an advantage to have the thin nichrome wire (C) which serves as the hot wire connected with a 'connector' (D) to a thicker wire (E) which is joined to the wooden handle. This gives a firmer control of the heated wire and also prevents sparking and breakage of the thin hot wire, if contact with the pillar is disturbed. Nichrome wire of about 0.3 mm. thickness serves well for the hot wire.

The wiring of the apparatus is simple. One terminal from the main supply is connected with pillar (B), the other terminal passes through the foot press switch and then through the resistance to pillar (A).

To use the apparatus the thin nichrome wire is wound around the neck of the ampoule, or the tube, or bottle at the point where it is desired to cut, and contact made with pillar (B) by passing the wire into one of the slits. Care must be taken that the wire from the two ends of the loop do not make contact with each other. This is easily done by adjusting the level of the wire. The wire is kept taut by traction on the handle. This traction must be maintained during the subsequent heating of the wire as it expands appreciably. The current is turned on by pressing the foot switch. The wire becomes red hot and after about  $\frac{1}{4}$  to  $\frac{3}{4}$  minute (depending on the quality and thickness of the glass) a minute drop of water is applied to the glass at the level of the wire loop and the glass cracks clean at the level of the loop. Water is not necessary for soft glass tubes. They crack readily with the hot wire. It should be noted that the loop of nichrome wire which goes round the glass does not glow red hot. Ampoules and small-sized tubes can be clamped in the clamp fixed on the board (shown in the diagram).

For opening ampoules of vaccines, sera and other material where it is important to avoid extraneous contamination this apparatus is arranged in a 'hood' and after the necks of the ampoules are thoroughly cleaned (conveniently done by arranging the ampoules necks down, dipping into carbolic acid in short stumpy test-tubes), the necks are cracked with the hot-wire loop. A sterile throat swab moistened in sterile water is used or a drop of sterile water from a pipette can be used.

The device has proved sufficiently useful, efficient and simple of operation to warrant a short note on the modified form. The accompanying drawing gives the general plan of the apparatus which can be made in any laboratory. The cost of the materials used in building up the apparatus is about four rupees (or six shillings).

## (v) METAL PETRI-DISH COVERS

By C. L. PASRICHA

and

K. BANERJEE

The breakage of glass petri-dishes during use, sterilization and more particularly during cleaning is a matter of no little importance to many laboratories. It was estimated that with two hundred and fifty pairs of petri-dishes in circulation the life of glass petri-dish is about 4 to 5 months. It is extraordinary how often the glass lids alone are broken and a number of unpaired petri-dishes accumulate. Many of these are used for various purposes in the laboratory and



purposes and because of their low cost no attempt is made to remove them after use.

### Summary

As substitutes for glass coverslips, the price of which has increased considerably since the outbreak of war, coverslips cut from old x-ray or photograph films (after removal of the gelatine coating), or from mica sheets give satisfactory results.

#### (viii) A DOUBLE LOOP FOR BACTERIOPHAGE WORK

By C. L. PASRICHA

A loop of the type shown in the text-figure has been in use for some years and has proved exceedingly useful in putting up cross-tests for the determination of the type of phage, or in testing the susceptibility to bacteriophage of strains of bacteria. In both these tests, loopfuls of bacteriophage are placed on long strips of inoculums of the secondary cultures or of the strains under test. When the ordinary single loop is used this entails the opening of the tube containing the test bacteriophage and charging the loop with it separately for each culture. By the use of the 'double loop' the number of times the loop has to be charged is halved. This saves considerable time and reduces by half the somewhat irksome and tiring process of adding drops in performing a cross-test.



The loop is made of nichrome wire of approximately 0.5 mm. thickness. The two small loops face one another. The sterilized 'double loop' is put into the bacteriophage suspension and lifted out edgewise (not with the flat surface of the loop parallel with the surface level of the fluid). By withdrawing the loops 'edgewise' the two small loops contain equal amounts of bacteriophage and there is no tendency for the fluid in the two loops to run into one another as happens if the loops are withdrawn flat surface upwards. After withdrawal one loop is touched gently on one inoculum and then by turning the handle round the other loop is touched on the second inoculum.

#### (ix) A SIMPLE EASILY-PREPARED COVER FOR MICROSCOPE AND OTHER APPARATUS

By C. L. PASRICHA

and

K. BANERJEE

A description of a simple easily-prepared dust cover for microscope and other apparatus is given below. Such covers have been in continuous use for more than 3 years and have given entirely satisfactory service. The dust cover consists of five tin-framed 'cellophane' panels soldered together as shown in the text-figure. It is advisable to reinforce the soldered joints by a bent

strip of tin and to paint the tin surfaces. Old x-ray films can be used in making these covers. There are many advantages of a cover of this type over the glass bell-jar dust cover. Some of these advantages are enumerated below :—

1. Dust covers of any desired size can be prepared in the laboratory. All that is required is sheets of transparent cellulose material (or old x-ray films), tin sheets and a soldering apparatus. Their cost is a very small fraction of the price of glass bell-jars.

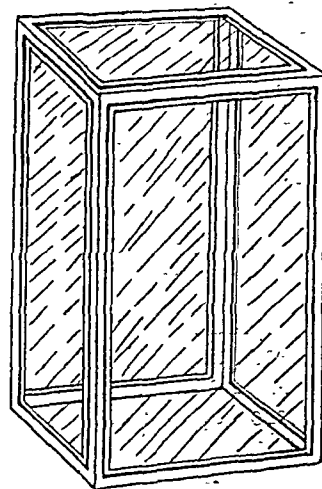
2. They withstand a great deal of rough treatment and are almost unbreakable.

3. Because of their lightness there is no danger of damage to any screw or other projecting part of a microscope or other apparatus over which such covers are used. When a bell-jar is used, great care must of course be exercised in placing it over the microscope, lest it strike and damage any part of the instrument. No such precaution is necessary with these light covers.

4. By making the covers of graded sizes so that one fits into the other it is possible to prepare a 'nest' of covers, and thus to save considerable space in storage and transport.

5. If desired pieces of rubber tubing (cut longitudinally) can be fixed on the sides of the mouth of the dust cover.

6. The dust cover can be painted a light yellow or red on the inside to filter the light. Black paper (from the coverings of old x-ray films) pasted on the inside of the cover is satisfactory.



#### (x) WAR-TIME ECONOMY IN THE LABORATORY

By C. L. PASRICHA

With the reduction of supply of both raw materials and finished products and the need for economy under the present war conditions, it is being increasingly realized that there is wealth in scrap or waste materials that are usually thrown away or disposed of at a very low price. Prices are rising and stocks are diminishing, and it is desirable therefore not only to prevent waste, but to explore every opportunity of salvaging and utilizing what would otherwise be discarded. For example, old x-ray films, photograph or cinema films are as a rule thrown away, or sold at a nominal price. These old films can be put to good use in the laboratory. After removal of the photographic film (easily done by hot water), the cellulose material can be put to a number of uses: (1) for framing photographs, charts, and

diagrams, (2) cut into small squares it can be used as coverslips, (3) dissolved in acetone or alcohol and ether, or amyl acetate, it forms an excellent substitute for collodion, and can also be used for cementing glass. Serviceable cellulose caps for bottles can be made from solution of old x-ray films. As further examples of the utilization of waste material or substitute materials the following are cited :—

1. Cotton-wool plugs, etc., can be salvaged and can often be utilized at least once again.

2. Instead of using brown paper for wrapping laboratory apparatus for sterilization, old newspapers which cost but a fraction of the price of brown paper are satisfactory for this purpose.

3. For filtration of coarse material, as for example before filtration through candle filters or asbestos discs, the material is passed through a column of fine quality sand instead of Kieselguhr.

4. As a substitute for cedar-wood oil for microscopy liquid paraffin is used by many workers. It is not often realized that there are many oils (locally available and at small cost) which can be used. Of these ground-nut oil can be used except where very critical definition is required. Hydnocarpus oil gives better definition than many samples of liquid paraffin.

5. Agar agar—The price of agar has increased considerably since the beginning of the war. Whereas the price was Rs. 3 per pound before the war, it is now Rs. 9-8 a pound for very inferior quality agar. It is possible to salvage a considerable amount of agar from used plates, sterilize it and use it again for ordinary routine purposes. Such agar is satisfactory for the growth of the less fastidious bacteria.

6. Instead of using flasks (which are considerably more expensive now than before the war) bottles of appropriate size can be used. A number of such bottles can often be found amongst the empty bottles that accumulate in a laboratory or in the central stores of a large institution. Bottles of good quality glass are manufactured locally and can be purchased at reasonable prices. The quality of the glass can be easily tested by standard methods (*British Pharmacopœia* : Appendix). Bottles have been introduced for the preparation and storage of media and have proved entirely satisfactory. They stand sterilization well.

7. Instead of wooden packing cases for small specimens sections of bamboo can be used. The bamboo cases are so cut that one side is closed by the natural joint and the other side is closed with a cork or a piece of pith and paper reinforced with wire.

The above are some examples of the many ways in which economy can be effected without loss of efficiency. Such examples can be multiplied many times and will suggest themselves to laboratory workers. These are cited in the hope that they will stimulate workers to develop

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## THE STERILITY OF SNAKE VENOM SOLUTIONS

By C. L. PASRICHA

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Professor of Bacteriology and Pathology

and

Z. ABEDIN

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THE hæmostatic effect of viperine venom and the analgesic effect produced by cobra venom have made venom therapy a popular form of treatment, particularly in chronic painful conditions. In addition to these specific indications snake venoms are in considerable vogue in some centres and are administered in an increasing number of clinical conditions. The venom preparations are used differently, (a) by direct local application, or (b) by intradermal, subcutaneous, or even intravenous injections.

A severe reaction after a subcutaneous injection of snake venom led to the examination of the venom solution that had been used. This solution contained many viable bacteria. A further 24 samples of venom solutions were examined for sterility. Standard methods of testing were employed, using sufficient fluid medium to ensure that the preservative content of the final dilution shall be less than 0.01 per cent. For the purposes of this calculation the maximum content of the preservative was taken to be 0.5 per cent. Each venom was examined for the presence of aerobic and anaerobic bacteria. The results are summarized below :—

Venom	Number examined	Number passed sterility test	Number not passed sterility test
Cobra ..	11	9	2
Viper ..	14	8	6

The crude venoms when collected are grossly contaminated and the difficulty of obtaining sterile solutions of venoms are well known to all responsible for the preparation of such solutions. Many methods have been advocated for the preparation of sterile solutions. The most satisfactory solutions (as far as the sterility

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such alternative methods and to report them. It is the simple and obvious alternatives that are so valuable and are so often missed.

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735.



## MAINTENANCE OF BACTERIAL CULTURES

By M. K. KRISHNA MENON, M.B., B.S.  
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- IN most laboratories in the North American Continent and in England, the older methods of maintaining bacterial cultures by constant sub-culturing in suitable media have of recent years been largely superseded by the method of rapid freezing and dehydration *in vacuo*. As early as 1896, Martin suggested the possibility and procedure involved in the preservation of guinea-pig complement in the dried state. Noguchi, in 1907, dried complement and amboceptor on filter paper. Shackell, in 1909, dried complement in the frozen state and showed that it could be preserved for months. Karsner and Collins, in 1919, applied Shackell's method for the preservation of various sera and, in 1923, Hartley and his associates reported the dehydration of complement by distilling off the  $H_2O$  *in vacuo*. In 1931, Craigie dried complement in the frozen state by means of a vacuum desiccator and more recently Elser and his co-worker (1936) showed conclusively that biological materials could be dehydrated from the frozen state. This method was admirably developed by Flosdorf and Mudd (1935) in the University of Pennsylvania and resulted in their dry ice 'lyophile apparatus' by means of which many biological materials could be preserved for several months without any detectable deterioration. The same investigators, in a later communication, in 1938, described a new process where the condensation of water vapour in a low temperature bath (dry-ice methyl cellosolve mixture) is replaced by the use of an inexpensive chemical desiccant (the Cryochem process). The method has been very profitably employed for the preservation of various anti-toxins, guinea-pig complement, human plasma for purposes of transfusion, normal and convalescent human sera, enzymes, viruses, bacteria and miscellaneous proteins.

The procedure and apparatus to be described in this communication are a modification of the 'Cryochem process' described by Flosdorf and Mudd in 1938. This has been successfully employed in the preservation of bacterial cultures though it can be used for preservation of sera, protein solutions and other labile biological materials with equal success.

*The apparatus*

A diagram of the apparatus is shown. The containers used are a number of 1 c.cm. ampoules

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tests are concerned) were obtained with solutions that had been filtered through an asbestos filter. These results are recorded to draw attention to the importance of control by sterility tests of injectable substances.

which are attached to pressure tubing. Any number of containers can be attached by using a multiplicity of glass Y-tube connections. The attachment of the containers leads to two glass cylinders containing either fresh or freshly regenerated anhydrous calcium sulphate (known under the trade-name drierite). Drierite is a comparatively low cost chemical with a powerful affinity for water and is capable of producing a low aqueous tension very rapidly. Also it has no vapour pressure of volatile substances and can cause no harmful effects on labile materials such as has been reported with  $H_2SO_4$  or acid phosphoric anhydride. An additional advantage is that used calcium sulphate can be regenerated for further use by heating for about 6 hours in an oven at  $150^\circ C.$  to  $250^\circ C.$  ( $180^\circ C.$  is optimal). The glass cylinders containing drierite are connected to a mercury manometer and a Cenco-Hyvac pump.

*The operation of the Cryochem apparatus*

The apparatus should first be tested for vacuum tightness with the outlets shut off.

Sterile skimmed milk has been found to be the best medium in which to suspend the bacteria. Overnight cultures of organisms are made and the growth is made into a semi-solid emulsion by adding a small amount of milk. Work during the whole operation should be carried out under sterile conditions lest the cultures should get contaminated. With a sterile capillary pipette about 0.2 c.cm. of the thick emulsion is introduced in each container which is immediately attached to the rubber tube after duly flaming the mouth of the ampoule and the tip of the rubber tubing. Any number of containers can be attached in this way. It is the general practice here not to use more than 24 tubes at one sitting. It becomes cumbersome to use more tubes and also the chances of leakage of air into the system become greater. The degassing self-freezing procedure is employed. Preliminary degassing is accomplished by reducing the pressure slowly and allowing the system to remain under this low pressure for about half an hour. Further reduction of pressure is obtained up to the point where frothing just begins to occur. This accelerates the degassing process. Consequent on the rapid evaporation taking place from the material the temperature of the substance falls and freezing sets in with a suddenness very much like the sudden crystallization of supersaturated solutions. In this manner, the advantages of rapid freezing are obtained without the use of refrigerants, such as dry ice bath with alcohol, ether, acetone, etc. When degassing is complete and the material is frozen, the pump is allowed to evacuate to the limit of its capacity. By the time the frozen material has reached the fusion temperature, the air pressure is reduced to such an extent that moisture is taken up by the drierite with sufficient rapidity to maintain the material in the frozen state. Drying from the

frozen state has been found to be complete in 4 to 6 hours, when not more than 0.2 c.cm. of the bacterial emulsion is used for each container. The time required, of course, varies with the thickness of the layer of material in the container and with the nature of the material itself. It may be advisable to allow determination of the residual moisture content by the method described by Flosdorf and Webster (1937) to decide the duration of processing. If sufficient drying time is allowed, the final moisture can be reduced to less than 0.1 per cent which corresponds to 99.9 per cent removal of the original water.

Evacuation is carried out to the limit of the capacity of the pump. Occasionally it happens that the pressure does not fall to the proper level, and in that event search should be made for leaks in the containers and container assemblies. A defective container is either sealed off or otherwise removed. After proper pressure is obtained, the apparatus requires no further attention until desiccation is complete, other than occasional inspection to see that the motor does not get too hot and to insure against failure of the electric power, etc. While drying specimens of vaccinia virus the apparatus has been allowed to run overnight, much in excess of the minimal requirements, without any trouble.

After drying is complete, the containers are sealed individually without breaking the original vacuum and properly labelled. Before releasing for storage, it would be advantageous to test these containers with a spark coil vacuum tester to ensure retention of vacuum. If the coil is made to touch the outside of the tube, a violet glow will appear in the tube if the vacuum is satisfactory. If there is a leakage, air and moisture get in with consequent deterioration or complete loss of viability of the bacteria. The ampoules are preserved in the cold room though our observations indicate that preservation at room temperature, at least for six months, does not materially affect viability. Flosdorf observed that the duration of activity of the dried material at room temperature from 0°C. to 25°C. storage for long intervals should be at refrigerator temperature.

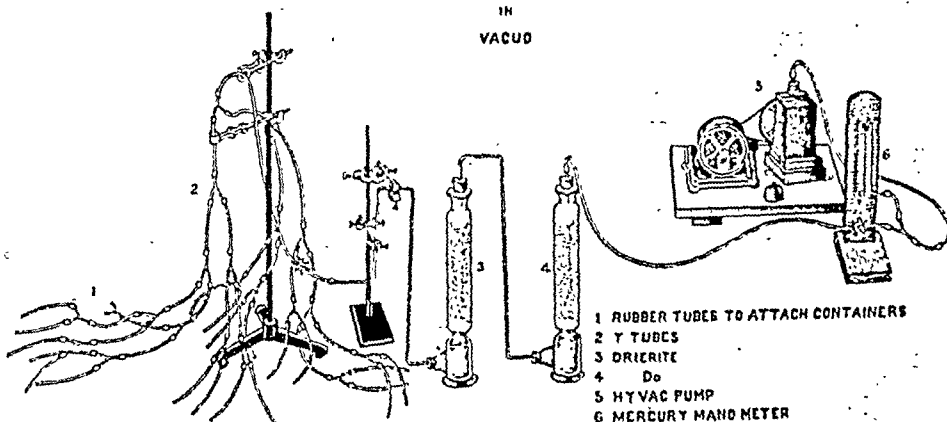
At the time when the product is to be used, one of the ampoules is broken, the dried material emulsified in a little nutrient broth and then inoculated in suitable media and incubated. Invariably abundant growth takes place in 24 to 48 hours, the colonies appearing quite smooth.

The longest period for which the test has been done so far in this laboratory was ten months and tests covering longer periods are being made. It has been noted that the contents of an occasional tube, when tested, failed to grow on sub-culture. It is believed that this was due to defective sealing of the container which permitted the entry of air and with it aqueous vapour. The spark coil vacuum testing obviates this possibility.

This procedure has been adopted in maintaining experimentally a wide range of organisms, including such delicate bacteria as the *Neisseria gonorrhoea*, *Neisseria meningitidis*, *Haemophilus influenzae*, *Haemophilus pertussis*, etc. The viability of the organisms was tested at various intervals of time. A table showing the organisms tested and the longest period they have been found to survive is appended.

Clearly, this method of preserving micro-organisms provides a means of preserving bacterial cultures at low cost. There is considerable elimination of time and labour and expense of medium involved in constant subculturing. Storage and distribution to other laboratories

APPARATUS FOR DRYING  
BACTERIAL CULTURES SERUMS  
IN  
VACUO



are very much facilitated. Furthermore, this method minimizes the tendency towards bacterial variation and impairment of antigenic capacity often encountered in laboratory sub-cultures.

#### Summary

The procedure and apparatus for preservation of bacterial cultures have been described in detail. The degassing self-freezing technique is employed by making use of a cheap desiccant (anhydrous calcium sulphate). No dry ice or any other refrigerant is used. The product obtained in this way by rapid freezing and rapid dehydration is sealed in glass ampoules *in vacuo* and stored.

#### Acknowledgments

I wish to acknowledge gratefully the technical assistance rendered by Dr. G. N. V. Krishnan  
(Continued at foot of opposite page)

## ON THE COMPOSITION OF BUFFALO MILK AND THE DETECTION OF ADULTERATED SAMPLES PASSED AS COW MILK\*

By N. K. GHOSH, M.B., D.P.H., D.T.M.  
and

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ANALYSES performed in the laboratory for the purpose of the Assam Pure Food Act, 1932, have shown that samples of buffalo milk which contain a comparatively higher amount of fat and solids-not-fat are sometimes skilfully adulterated and sold as cow's milk, maintaining the standards (minimum for cow's milk, specific gravity 1028 at 15.5°C., fat 3.5 per cent and solids-not-fat 8.5 per cent) within the legal limit.

To devise a suitable method for the detection of such adulteration, a detailed investigation of the composition of a number of genuine samples of buffalo and cow milk had to be undertaken.

\* Received for publication on 12th July, 1940.

(Continued from previous page)

in the course of this work. I am thankful for the helpful comments received from Lieut.-Colonel H. E. Shortt, C.I.E., I.M.S., during this work.

TABLE

Showing the survival of various species of bacteria in the dried state

Organism tested	Period after drying
1. <i>N. meningitidis</i> ..	10 months
2. <i>Streptococcus pneumoniae</i> ..	9½ "
3. <i>N. gonorrhoea</i> ..	8½ "
4. <i>H. pertussis</i> ..	8½ "
5. <i>B. dys. Shiga</i> ..	8 "
6. <i>B. dys. Flexner</i> ..	8 "
7. <i>B. coli</i> ..	8 "
8. <i>B. pseudocarcinigenus</i> ..	7 "
9. <i>B. typhosus</i> ..	6½ "
10. <i>H. influenza</i> ..	6½ "
11. <i>Streptococcus haemolyticus</i> ..	6 "

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\* Not in author's typescript: supplied by editorial staff of the *Indian Medical Gazette*.

Altogether 613 samples of milk were analysed, of these 382 were cow milk and 231 buffalo milk. The majority of these samples were obtained from Government cattle farms in this province (Assam) and the rest were procured from animals milked in the presence of health officers or sanitary inspectors from different places in the province. All samples were obtained by mixing the complete yield of the animal and no foremilk was sent for examination.

In this note we have tabulated some of the results of analysis and have shown that the fat and the solids-not-fat in many samples of buffalo milk are such that these can be easily adulterated and passed as genuine cow milk within the legal limit, but the lactose content of the buffalo and the cow milk varies within a similar and narrow range, and, therefore, the estimation of lactose facilitates the detection of such adulteration, when water alone has been used as the adulterant.

## 1. Specific gravity of buffalo milk

The specific gravity of 231 samples of buffalo milk determined by the lactometer varied from 1028 to 1040 at 15.5°C. The present legal standard for buffalo milk as prescribed for the Assam Pure Food Act, 1932, is a minimum of 1028 at 15.5°C. No sample was found below this limit.

## 2. Fat percentage in buffalo milk

Fat was estimated by Gerber's method.

TABLE I  
Fat content of buffalo milk

Fat, per cent	Number of observation	Percentage of total samples analysed
* 2.0	1	0.43
3.0	2	0.86
3.5	3	1.30
4.0	3	1.30
4.5	4	1.74
5.0	22	9.52
5.5	17	7.36
6.0	23	9.96
6.5	43	18.61
7.0	19	8.23
7.5	14	6.06
8.0	18	7.80
8.5	10	4.33
9.0	20	8.65
9.5	10	4.32
10.0	12	5.20
10.5	3	1.30
11.0	6	2.60
12.0	1	0.43
TOTAL ..	231	100.00

\* Each figure in the first column of Table I includes  $\pm 0.25$  per cent of the milk constituent under consideration.

Table I shows that a considerable number of samples of buffalo milk examined had a fat

content of 5 per cent or above, but below the legal limit of 6 per cent.

As the milk samples examined during the present investigation sometimes include more than one sample from the same buffalo (particularly in the case of the buffaloes belonging to a Government Cattle Farm), the following table has been prepared to show that such samples of milk (with fat content below 6 per cent) were obtained from different animals and that the other constituents were within the legal limit (specific gravity 1028, solids-not-fat 9 per cent).

TABLE II

*Analysis of buffalo milk containing low fat*

Place	Date (1939)	Buffalo number	COMPOSITION			
			Sp. gr	Fat, per cent	S. N. F., per cent	Lactose, per cent
Govt. Cattle Farm, Sylhet.	6-3	11	1035	5.2	10.9	5.15
	11-3	6	1035	5.2	10.1	4.95
	6-6	5	1030	5.1	12.0	4.94
	21-9	13	1037	5.5	11.1	4.98
	21-9	16	1037	5.2	11.0	4.80
Silchar (district Cachar).	25-9	12	1038	5.4	11.4	4.88
	18-4	2	1036	5.1	12.9	4.95
	18-4	3	1036	5.2	10.8	4.47
	22-6	17	1032	5.1	13.2	4.72
	30-6	21	1035	5.7	12.7	5.07
Shillong		24	1035	5.5	9.5	5.29
		20	1034	4.8	12.6	4.74
	12-8	30	1028	5.8	15.4	4.76
	5-5	Milk	1033	4.8	11.4	4.00
	29-5	"	1031	5.5	9.2	4.03

### 3. Solids-not-fat

Solids-not-fat was estimated as usual by the evaporation of 10 c.cm. milk to a constant weight.

TABLE III

*Solids-not-fat content of buffalo milk*

Solids-not-fat, per cent	Number of observations	Percentage of total samples analysed
8.0	Nil	0.00
8.5	2	0.86
9.0	20	8.65
9.5	15	6.50
10.0	32	13.85
10.5	45	19.50
11.0	32	13.85
11.5	30	12.99
12.0	21	9.10
12.5	14	6.06
13.0	12	5.19
13.5	6	2.59
14.0	1	0.43
15.5	1	0.43
TOTAL ..	231	100.00

### 4. Lactose in buffalo milk

For rapid estimation of lactose in milk, the method described by Ghosh and Datta Roy (1940) was adopted.

Most of the samples examined were formalized milk, so the efficiency of formalin preservation of milk for the purpose of lactose estimation was verified and it was found that 3 drops (0.15 c.cm.) of formalin (40 per cent by volume) when added to 6 ounces of milk and placed in a corked phial preserved milk samples for 12 days without causing any significant deterioration in the lactose content.

TABLE IV

*Lactose content of buffalo milk*

Lactose, per cent	Number of observations	Percentage of total samples analysed
3.8	Nil	0.00
3.9	Nil	0.00
4.0	16	7.30
4.1	7	3.20
4.2	14	6.40
4.3	12	5.50
4.4	11	5.05
4.5	10	4.60
4.6	15	6.90
4.7	22	10.10
4.8	39	17.90
4.9	22	10.10
5.0	23	10.55
5.1	16	7.35
5.2	8	3.65
5.3	3	1.40
TOTAL ..	218	100.00

TABLE V

*Lactose content of cow milk*

Lactose, per cent	Number of observations	Percentage of the samples analysed
3.7	Nil	0.00
3.8	4	1.04
3.9	6	1.57
4.0	13	3.40
4.1	17	4.45
4.2	25	6.55
4.3	35	9.16
4.4	43	11.25
4.5	45	11.78
4.6	38	9.95
4.7	44	11.53
4.8	53	13.87
4.9	27	7.07
5.0	22	5.76
5.1	7	1.84
5.2	2	0.52
5.3	1	0.26
TOTAL ..	382	100.00

### 5. The freezing point of milk

The freezing point is the most constant property of milk. Freezing points of a few samples

of buffalo milk were determined following the work of Andrew (1929), with the help of the simple form of Beckmann's freezing point apparatus, but anomalous results were obtained. Later, it was found that the varying results were due to the addition of formalin as a preservative. All the samples of buffalo milk had to be brought to the laboratory from distant places and no opportunity was found to study the effect of formalin on fresh buffalo milk.

The following study was made on fresh milk obtained from a cow kept under our observation, which will be mentioned in table VI as laboratory cow milk.

TABLE VI

*The effect of addition of formalin on the freezing point of milk*

Description of milk	Formalin, 40 per cent	Freezing point
Laboratory cow milk		- 0.550°C.
Milk 2 ounces ..	2 drops (0.1 c.cm.)	- 0.580°C.
" 2 " ..	4 " (0.2 c.cm.)	- 0.600°C.
" 2 " ..	6 " (0.3 c.cm.)	- 0.640°C.

From the above table it will be seen that the addition of formalin causes a considerable

table that the dilution of buffalo milk with water or starch emulsion (in practice, the dishonest vendor often uses the supernatant water from boiled rice) may be carried out in such a way that the specific gravity, fat, and solids-not-fat remain within the minimum standards : 1028, 3.5 per cent and 8.5 per cent respectively prescribed for genuine cow milk. But the range of lactose content of the buffalo and the cow milk being almost the same (*vide* tables IV and V), such dilution or adulteration of the buffalo milk, if it is to be made profitable, brings the lactose value below 3.8 to 4 per cent, the minimum value for genuine cow milk obtained by us. Of course, if the adulteration be slight only, the estimation of lactose will not help to detect it. In preparing adulterated samples within legal standards for cow milk, the only difficulty occurred regarding the proper adjustment of the specific gravity, otherwise about 50 per cent of the samples of buffalo milk analysed (to a limit of solids-not-fat 11 per cent and fat 7 per cent) by us could be very profitably adulterated and passed as genuine cow milk. Cane sugar, starch solution, or rice-water can be detected in milk by very easy tests, but the detection of adulteration becomes difficult when the buffalo milk has been diluted with water only. In such cases of adulteration, the estimation of lactose will be useful.

Description of buffalo milk	Details of adulteration	ANALYSIS OF THE ADULTERATED MILK			
		Specific gravity	Fat	Solids-not- fat	Lactose
Shillong 'Pooled'	Milk 3 parts + water 2 parts + sugar	1028	3.5	8.5	2.48
Sylhet No. 12 ..	Milk 3 parts + starch emulsion 2 parts	1030	3.5	8.5	2.81
Sylhet No. 16 ..	Milk 55 c.c. + starch emulsion 45 c.c.	1028	3.5	8.5	2.77
Sylhet No. 6(A)	Milk 1 part + water 1 part + sugar	1028	4.1	9.1	2.19
Sylhet No. 6(B)	Milk 3 parts + water 1 part + sugar	1029	8.0	8.8	3.30
Dibrugarh No. 5	Milk 4 parts + water 1 part	1031	6.5	8.6	3.65
Sylhet No. 13 ..	Milk 3 parts + water 1 part	1028	5.8	8.5	3.72
Dibrugarh No. 4	Milk 3 parts + water 1 part	1030	5.4	9.2	3.42
Silchar 'X' ..	Milk 3 parts + water 1 part	1029	4.9	9.5	3.50
Dibrugarh No. 2	Milk 5 parts + supernatant water from boiled rice 2 parts.	1030	6.7	9.3	3.60

shifting of the freezing point. The determination of the freezing point is unsuitable for routine estimation of the specimens of milk, which generally are sent to the public analyst after formalin has been added as a preservative.

#### 6. Detection of adulterated buffalo milk passed as cow milk

Analyses which have been described above show that in genuine buffalo milk the specific gravity may be as high as 1040, fat 12 per cent and solids-not-fat 15.5 per cent. A fat content of 8 to 10 per cent and solids-not-fat 11 to 13 per cent are common in the buffalo milk of Assam. It has been shown in the following

#### Discussion

The Assam Pure Food Act, 1932, and the Food Acts in force in Calcutta and Bengal and Bihar and Orissa demand that a genuine sample of buffalo milk should contain a minimum specific gravity 1028 at 15.5°C., solids-not-fat 9 per cent and fat 6 per cent.

From the analysis of 231 samples of genuine buffalo milk which have been recorded here, it appears that the minimum specific gravity and the solids-not-fat demanded are quite reasonable. But 22.51 per cent of the samples of milk analysed (table I) fall below the limit of 6 per cent fat content. If however the minimum standard for fat is reduced to 5 per cent

only 5.62 per cent of the samples remain below the limit. Table II shows that, at least in Assam, many samples of genuine milk from buffalo may contain as low as 5 per cent fat, and, if a sample of cow milk containing 3.5 per cent fat can be legally allowed to be sold as wholesome food, there is no reason why from the nutritional point of view, samples of genuine buffalo milk containing 5 per cent fat and satisfying other standards should not be legally considered as a pure food.

From the analysis of 218 samples of genuine buffalo milk it has been found that the range of lactose varies from a minimum of 4 per cent to a maximum of 5.3 per cent, whereas in cow milk (382 samples analysed) the range is from 3.8 to 5.3 per cent; only 2.67 per cent of the samples of cow milk analysed showed a lactose content lower than 4 per cent. During the progress of this enquiry it has been repeatedly observed that the fat content of the milk samples from an individual buffalo or cow varied from day to day within a wide range, but the lactose content remained fairly constant. Further, it has been found that in the majority of the samples of buffalo milk, which showed a high fat content (7 per cent or more), the lactose value generally was 4 to 4.8 per cent. Many of the samples which showed a higher lactose content (4.9 per cent or higher) often contained 6 per cent or less fat and were not suitable for dilution for the purpose of passing as cow milk.

At present, no standard for lactose is prescribed for buffalo or cow milk in the Assam Pure Food Act. It is suggested that at least in those provinces where the supply of buffalo milk is abundant and adulterated buffalo milk is sold as cow milk (which always fetches a better return) a minimum standard of 4 per cent lactose should be imposed for both cow and buffalo milk for the purpose of pure food acts. It has been proved from table VII that the dilution of buffalo milk containing a high amount of fat and solids-not-fat, if it is to be made profitable, brings down the lactose content lower than 4 per cent.

According to the Bengal Food Act, a minimum lactose content of 4.4 per cent and the specific

gravity between 1028 and 1030 at 15.5°C. are demanded for both cow and buffalo milk. We have found that for the province of Assam at least, a minimum of 4.4 per cent lactose content will be too high and a minimum of 4 per cent is recommended as a suitable one for both cow and buffalo milk.

As regards specific gravity we have observed that in many samples of genuine cow and buffalo milk the specific gravity exceeds 1030, for buffalo milk it may go up to 1040 and for cow milk to 1039; a minimum of 1028 specific gravity as demanded by the Assam Pure Food Act, for both cow and buffalo milk, is quite reasonable.

Our thanks are due to Lieut.-Colonel A. M. V. Hesterlow, I.M.S., Director of Public Health, Assam, for his permission to publish this paper.

Our thanks are due to Mr. R. C. Woodford, Deputy Director of Agricultural Live-Stock, Assam, for facilities rendered to obtain genuine samples of milk from Government Cattle Farms, to the Health Officers and Sanitary Inspectors especially to Dr. J. M. Roy of the Silchar Municipality, for their co-operation in conducting this work during the enquiry on the detection of adulteration of foodstuffs, under the Indian Research Fund Association.

### Summary

Detailed analysis of 231 samples of buffalo milk and the lactose content of 382 samples of cow milk have been recorded. It is suggested that a minimum of 6 per cent fat for genuine buffalo milk demanded by some of the Pure Food Acts should be modified to 5 per cent and a lactose standard of 4 per cent (minimum) should be enforced for both buffalo and cow milk. It has been shown that the estimation of lactose facilitates the detection of diluted buffalo milk sold as cow milk.

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## A Mirror of Hospital Practice

### A CASE OF ACUTE THROMBOCYTOPENIC PURPURA

By L. EVERARD NAPIER, F.R.C.P. (Lond.)  
and

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(From the School of Tropical Medicine, Calcutta)

THE patient, a boy aged 9 years, was admitted into the Sir John Anderson block of the Medical College Hospitals, under Dr. P. N. Ray, as a case of cellulitis of the face.

On re-examination, it was found that the condition was due to a subcutaneous hæmorrhage which gave a peculiar purple colour to the skin over the tissues. Dr. Ray asked us to see the patient, we agreed to take him over, and he was subsequently transferred to the Carmichael Hospital for Tropical Diseases as a suitable case for investigation.

*History.*—The boy, the only child of young healthy parents, became suddenly ill about 10 days ago in his native village in Barisal. The illness started with a sudden high rise of temperature with definite chill. The

right side of the face began to swell; at first only the right cheek was swollen, but the swelling rapidly extended both upwards and downwards, and in the course of 3 to 4 days the whole face from the forehead down to the chin became a swollen purple mass. The village doctor diagnosed the case as cellulitis of the face and sent him down to Calcutta.

The boy had never had any serious illness before this.

*Family history.*—There was nothing unusual.

*On examination.*—He was quite intelligent for his age. He was of average height and of slight build. He looked definitely anæmic.

At first, both sides of the face were swollen (figure 1) and the appearance was that of cellulitis, but it was more purple than red, it was not hot, and there was



Fig. 1.

no real evidence of inflammation at the time we first saw the patient. The condition was more or less confined to the face, from the hair margin on the forehead to the fold of the neck. Later, it spread further



Fig. 2.

down the neck and on to the chest and shoulder of the right side. After some time the left side of the face became normal, and the swelling and discoloration were essentially confined to the right side. On the nose

and upper lip there was a fairly sharp line of demarcation at the middle of the body, but on the neck the condition extended beyond the middle line. The whole area was dark purple in colour; it did not pit like oedematous tissue, but was spongy; gentle pressure caused a considerable flattening of the swelling, which immediately re-assumed its previous size and shape when the pressure was released. There was apparently a condition like a cavernous angioma which was emptied by pressure, but refilled rapidly. The skin of the lower part of the face and neck became thick and brawny, and the elephantoid condition of one side of the face pushed the nose over to the opposite side (figure 2). The right eye was kept closed the whole time he was in hospital, and with difficulty one saw the cornea which apparently remained quite healthy, probably because of the careful nursing. He had a low intermittent fever, nearly the whole time he was in hospital.

The spleen was enlarged—about 2 inches below the costal margin—and was soft; the liver was just palpable.

Nothing abnormal was found in any other organ and there was no pain or swelling in any of the joints. A few purpuric patches appeared from time to time on his lower limbs, but these could usually be associated with slight trauma.

#### Laboratory findings on admission

Hæmoglobin	..	4.67 gm. per 100 c.cm.
Red blood cells	..	1,460,000 per c.mm.
Reticulocytes	..	12.7 per cent.
Mean corpuscular volume	..	102.7 cu.µ.
Mean corpuscular hæmoglobin.	..	32.0 γγ.
Mean corpuscular hæmoglobin concentration.	..	31.1 per cent.
White blood cells	..	18,850 per c.mm.
	Per cent	Per c.mm.
Neutrophils	..	62 11,687
Lymphocytes	..	33 6,220
Large monocytes	..	5 943
Eosinophils	..	0 Nil
Abnormal cells	..	Two neutrophil myelocytes and twelve normoblasts per 100 white blood cells.
Van-den-Bergh test	..	Direct—negative; indirect —2.25 mgm. per 100 c.cm.
Platelets	..	1460 per c.cm.
Coagulation time	..	Three minutes (capillary tube method).
Bleeding time	..	Ten minutes (Duke's method).
Capillary resistance test (sphygmomanometer method).	..	Positive, i.e., decreased resistance of capillaries.
Prothrombin time	..	Twenty seconds (Quick's method).

*Treatment and progress.*—The boy was bleeding slowly but constantly, and this we thought to be the cause of the anæmia, so our first aim in treating the patient was to stop the bleeding, and to raise the number of circulating platelets. With these objects in view, we applied locally various hæmostatics one after another; these included iron, alum, snake venom, and whole normal blood; each of these stopped the bleeding, but only temporarily. Together with the local hæmostatics, 12 injections of vitamin C were given in doses of 200 mgm., some intravenously and others intramuscularly, also three injections of coagulin (Ciba) and two of hæmoplastin were given with temporary stoppage of the bleeding but without any improvement in the platelet count. Two injections of Russell's viper venom were given but these caused severe reactions and were therefore not repeated.

Transfusion of 250 cubic centimetres of fresh citrated blood was given on 18th February from a donor of the same group. This improved the anæmia slightly, but did not check the bleeding nor did it help to raise the platelet count.



The splenic enlargement had disappeared quite early. In spite of the various treatments given, the ecchymosis had extended for a short distance laterally to the other side of the face, and just across the middle line, upwards to the scalp and also downwards to the chest in the middle line.

Having failed to stop the hæmorrhage, we turned our attention to treating the anæmia with the hope that improvement of the anæmia might lead to stoppage of the bleeding as well.

Ferrous sulphate, in doses of 12 grains a day, was therefore given for 21 days, from 21st March to 11th April, 1940. This improved the blood picture and the number of circulating platelets was raised considerably, though the number was still under the critical level (60,000 per c.mm.).

By this time, the blood was slowly absorbed from under the scalp and the left side of the face, and, by the end of May, the swelling under the scalp and the left side of the face had disappeared, the boy had greatly improved in health and the blood picture had also improved, but the platelet count was again going down and he was still bleeding from the mouth.

Deep x-ray therapy was now tried. Altogether three courses of deep therapy were given at the Calcutta Medical College. On each occasion exposures were given on three different areas over the spleen, in cyclical rotation in doses of 68r every day.

In the first course, from 31st May to 14th June, 1940, altogether 12 exposures were given over the three different areas in rotation, so that each of the three areas had 4 exposures of 68r. This seemed to have slightly improved both the blood picture and the platelet count.

A second course of iron was now given from 18th June to 9th July, 1940. There was slight improvement in the hæmoglobin but both the red cell count and the platelet count fell, the latter quite appreciably. A second course of deep therapy was then given.

In the second course, 11th July to 18th July, only six exposures were given, so that each of the three areas had two exposures of 68r. After the second course, there was a marked improvement in the blood picture, and the platelet count went up considerably, though it was still below the critical level of 60,000 per c.mm.

As we had managed to raise the blood level to a point which would allow an operation, we recommended

so that each area had three exposures of 68r. During the third course of deep x-ray therapy, the hæmoglobin red cell and platelet counts came down appreciably, and so further deep-ray exposures over the spleen were not given.

Our subsequent treatment was not based on scientific reasoning but was purely empirical. Though the prothrombin time was well within normal limits, three injections of vitamin K (Kapilin) 5 mgm. each day for three days were given, but without any beneficial result.

A few days later vitamin P was given in the form of Hesperidin (Lilly), 2 tabs. twice daily, from 14th September to 30th September. This too failed to effect any improvement. Finally, five injections of Lilly's concentrated liver extract 2 c.cm. daily for five days were given. The patient was now going down, both in general health and in his blood picture. The father was again urged to allow splenectomy, but he refused and removed the boy (and incidentally most of the case notes) from the hospital.

*Comment.*—The case reported above is undoubtedly one of acute essential thrombocytopenia, both clinically and hæmatologically. It fulfilled four out of the five points laid down as characteristic of the disease, viz:—

- (i) Reduced platelet count below 60,000 per c.mm.
- (ii) Decreased capillary resistance.
- (iii) Normal coagulation time.
- (iv) Increased bleeding time.

The fifth characteristic point, viz, that of the failure of the blood clot to retract normally, was not investigated.

Though there could be no question regarding the diagnosis, we do not feel that the whole clinical picture could be explained on the grounds of essential thrombocytopenia alone. It seems probable that the original diagnosis of cellulitis was correct and that this was complicated by the hæmorrhagic diathesis. The angiomatous condition was probably due to a venous thrombosis and the elephantoid condition

to some lymphatic obstruction which were the result of the original inflammatory condition. It was possible that a low-grade inflammatory condition still persisted. Even if we had been able to improve the thrombocytopenic condition, it seems very improbable that much improvement would have taken place in the local condition without some plastic operative procedure.

Splenectomy is the only procedure that is likely to improve essential thrombocytopenia, and this the patient's guardians refused to allow.

The hæmorrhages in essential thrombocytopenic purpura vary directly with the number of platelets in the circulation—the fewer the platelets the more severe are the hæmorrhages, and hæmorrhage is rarely seen when the number of

platelets is above 60,000 per c.mm. (Minot, 1917).

Thrombocytopenia is apparently due to defective formation, or defective maturation, of

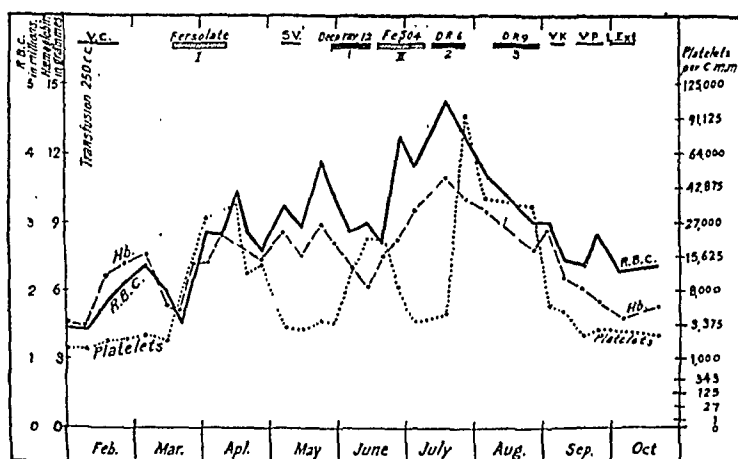


Fig. 3.—Progress chart.

V. C. = vitamin C.  
V. K. = vitamin K.  
V. P. = vitamin P.  
D. R. = deep rays.  
S. V. = snake venom.

removal of the spleen, but the patient's guardian refused.

After an interval of about a month a third course of deep rays was given, from 15th August to 29th August. In the third course, nine exposures were given,

the platelets at their site of origin, or to increased destruction in the spleen; these three factors may act singly or in combination. Examination of smears obtained by sternal biopsy gives some information about the formation and maturation of the platelets, but, although sternum puncture is done as a routine measure in all cases of anæmia and blood diseases under our care, we did not venture to do the operation on this boy because, as we have already stated, he used to bleed, sometimes for a long time, on the slightest prick. Thus we have no indication whether there was any defect in the formation or maturation of the platelets. Neither can we say whether excessive destruction of the platelets by the spleen was the cause of thrombocytopenia. For, though deep therapy was applied over the spleen, it was not sufficient to put the spleen out of action altogether, and the crucial test of splenectomy could not be done, as the relatives did not agree to any operative treatment.

**Summary.**—A case of acute essential thrombocytopenia is described in which the platelet count could not be raised above the critical level and the bleeding could not be stopped by hæmostatics, serum, vitamins, or by deep x-ray therapy over the spleen.

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### RECOVERY FROM PNEUMOCOCCAL MENINGITIS TREATED WITH M. & B. 693

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BEFORE the advent of chemotherapeutic treatment of pneumococcal meningitis with M. & B. 693 tablets, the prognosis in this disease was hopeless—once the case was diagnosed as pneumococcal meningitis, not even the remotest chance of its recovery was there. Ever since M. & B. 693 came to occupy the place it now does in the treatment of lobar pneumonia, hopes were aroused regarding the treatment of pneumococcal meningitis with the same drug. Lately, in the literature some recoveries from this dreaded disease, treated with M. & B. 693, have been reported. We have treated, in hospital and private practice, over a dozen and a half cases of pneumococcal meningitis with M. & B. 693 without a single recovery. We had, naturally, become rather sceptical about these reports and accepted them only with great reserve. This month, we have had two successful cases in the ward, and, since such a happy result is, as yet, far from being a common experience, we think it worth while bringing it to the notice of the profession.

**Case 1.**—A male, aged 17, admitted to the Irwin Hospital in the afternoon of the 10th February, 1941, in a delirious condition.

**History.**—Patient is a hawker by occupation. On the 9th instant, he suddenly fell ill with high fever, severe headache and generalized pain in the body. He very soon became delirious and markedly excitable. He had been like that till admission into the hospital. No past history of any kind was obtainable.

**Examination.**—On admission the patient was markedly delirious and showed signs of meningeal irritation. There was some rigidity of the neck muscles and Kernig's sign was positive. No abnormal signs were detected in the heart, lungs and abdomen. Temperature 99°F. in axilla. Pulse 120 per minute. Respiration 28 per minute.

A lumbar puncture was done immediately on admission and 20 c.cm. of an opalescent fluid were drawn out. Fluid was under moderate tension. There was no relief in symptoms after lumbar puncture. The cerebro-spinal fluid was examined immediately and the report is as follows:—Turbid, deposits present, protein increased, large number of polymorphonuclear leucocytes and very few Gram-positive diplococci morphologically resembling pneumococci.

**Blood examination.**—Hæmoglobin 55 per cent. Total leucocytes 12,500 per c.cm. of blood. Polymorphonuclears 77 per cent, lymphocyte 17 per cent, large mononuclears 4 per cent.

**Progress.**—10th February. Lumbar puncture findings referred to above. Since M. & B. 693 was not available, only symptomatic treatment was given.

11th February. Temperature 100°F. General condition same. Lumbar puncture was done in the morning and 50 c.cm. of turbid fluid was drawn out. Dr. H. R. Bhamboi, bacteriologist to the Irwin Hospital, very kindly supplied us with 25 tablets of M. & B. 693 for this case. The tablets were given as follows:—

4 tablets to start with,

4 tablets after 4 hours,

and then 2 tablets every 4 hours.

Morphia was needed for delirium, and retention of urine was relieved by catheter.

12th February. General condition better. Still some headache. Temperature came down to 96°F. Pulse 100 per minute. Lumbar puncture: 25 c.cm. of fluid taken out. Fluid still not clear.

14th February. General condition better. Had good sleep. Temperature subnormal. Lumbar puncture: 15 c.cm. of clear fluid drawn out.

15th February. Lumbar puncture: 15 c.cm. of clear fluid. Examination showed very scanty Gram-positive diplococci.

16th February. Lumbar puncture: 5 c.cm. of clear fluid.

17th February. Lumbar puncture: 2 c.cm. of clear fluid. Examination showed no pneumococci.

18th February. General condition good. Temperature 98.4°F. Lumbar puncture omitted.

19th February. Patient discharged as cured.

**Case 2.**—A girl, aged 16, admitted into the Irwin Hospital at 1 a.m. on the 17th February, 1941, with headache, fever and pain on movement, in the neck muscles.

**History.**—The illness started with headache and fever on the 15th evening. The headache became very intense in the evening of the 16th and led to the suspicion of meningitis.

**Examination.**—Patient looked seriously ill and was restless and somewhat delirious. No neck retraction was seen. Lungs, heart and abdomen showed no abnormality; Kernig's sign was positive.

Lumbar puncture: Cerebro-spinal fluid turbid and under tension. About 30 c.cm. came out. No relief in symptoms after it. Examination of the fluid revealed presence of pus cells and Gram-positive diplococci, morphologically resembling pneumococci.

Patient was put on M. & B. 693 tablets. Dosage same as in case 1.

**Progress.**—17th February. Temperature 103°F. Pulse 135 per minute, respiration 24 per minute. Lumbar puncture findings referred to above. Night passed badly

with little sleep. Lumbar puncture was repeated at 11 a.m. Only about 2 c.cm. of turbid fluid came out. Throughout the day the patient was restless and delirious. Hypnotics had very little effect. Temperature in the evening 102°F., pulse 125 per minute.

18th February. General condition better. Headache very much less. Some delirium still present. Morning temperature 101.8°F., evening temperature 98.4°F. Pulse also came down to 96 per minute in the evening. Lumbar puncture was done at 11 a.m. but only about 2 c.cm. of turbid fluid came out. Examination still revealed pus cells and pneumococci. Patient vomited M. & B. 693 tablets once.

19th February. General condition much better. No headache. Temperature subnormal. Pulse 95 per minute. Patient had good sleep at night. Feeling of marked æsthenia. Lumbar puncture omitted.

20th February. General condition good. Patient desirous of going home. Lumbar puncture: 2 c.cm. of clear fluid under normal tension. Examination revealed no pneumococci.

21st February. Patient discharged cured.

### Conclusion

Two cases of pneumococcal meningitis successfully treated with M. & B. 693 are reported. M. & B. 693 has come to occupy an important place in the treatment of lobar pneumonia and other pneumococcal infections in the body. Its success in pneumococcal meningitis is a great advance in the treatment of this disease. Why the drug succeeds in some cases and not in others will be elucidated as time passes and more and more case reports become available so as to find out the factors which are responsible for its not being uniformly successful.

My thanks are due to Lieut.-Colonel M. M. Cruickshank, chief medical officer, Delhi, for his kind permission to report these cases, and to R. S. Dr. H. R. Bhamboi for his generosity in supplying M. & B. 693 tablets for one case.

## DACTYLOMEGALY: A CASE NOTE

By WALTER BRINITZER

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THE case described is one of a continued growth of the bones of the right hand.

*Family history.*—Health and longevity are the outstanding features. Father and mother died aged 99 and 80 respectively. Six brothers and sisters—5 died aged 70, 65, 60, 55 and 44 respectively. One alive and well, aged 65. Twelve children—4 died in childhood of typhoid and small-pox; 8 alive and healthy. The family history reveals no cases of tumours, malformations, or chronic ill-health.

*Personal history.*—The patient, a man aged 60, was born in Bangalore and never left Mysore state except for a holiday to Delhi. He states that when he was 19 he had an attack of bubonic plague affecting the cervical glands of the right side. This did not accelerate the growth. Apart from this he gives no history of illness.

As long as he can remember he has had the deformity (figures 1 and 2). At first this consisted of only a slight thickening and lengthening of the right thumb and forefinger, but throughout his life it has continued to grow. At 25 his hand was about half its present size. At 45 the middle finger started growing. Until he was 50 he could eat with his right hand. From

boyhood he learned to use his left hand for all practical purposes and he dresses and helps himself in every way with it. He can write Kanarese, Hindi and Marathi fluently.



Fig. 1.

*Measurements.*—The circumference of the right forefinger (9½ inches) is the same as that of the left (healthy) upper arm. Its length (13 inches) is 2 inches



Fig. 2.

more than that of the left forearm. The circumference of his right thumb is 7 inches, which is 1 inch more than that of the normal left wrist. The thumb is half

the length of the forearm. The corresponding measurements in inches on the two sides are:—

	Right	Left
Circumference of wrist ..	11	6½
Circumference of forearm ..	12	9
Circumference of upper arm ..	11	9½
Length of forearm ..	12	11
Length of upper arm ..	14	14

**Examination.**—In the right extremity the colour and thickness of the skin and the distribution of hair appear normal, and it receives an undiminished blood supply. The nails however show trophic changes. The secretions, sweat and sebum are produced in normal quantities. All sensory impulses are carried normally. No active or passive movements of the thumb and forefinger are possible. There is slight movability of the middle finger. Motor function of the right little finger is unimpaired. The right forearm shows a subcutaneous lipoma. Due to the heavy weight of the right extremity and the desire to avoid unnecessary movements there is wasting of the biceps, infraspinatus and teres major muscles.

**X-ray.**—In the hand (figure 3) the first and second metacarpal bones are enlarged and thickened. There



Fig. 3.

is extensive proliferation of bone in the phalangeal joints. No joint spaces in between the phalanges are seen, as there is bony ankylosis. The phalanges are also enlarged and thickened. There is extra bone formation on the medial side of the first, second and third phalanx near the joint. In the wrist the carpal bones are not individually distinguished from one another, as there is proliferation of bones and bony ankylosis. In the forearm the radius shows thickening at its middle. Exostoses are seen in connection with the upper end of the radius.

**General examination.**—There is no other abnormality. Heart and lungs are normal, liver and spleen not palpable, reflexes present, genital organs normally developed, no changes in bones and joints, apart from his right arm. He does not even show any signs of senility (arcus senilis, atrophy of the skin, etc.), his mind is active and he takes a keen interest in various subjects. All his teeth except two are well preserved. The urine shows no albumin, sugar or urobilinogen. My first impression was that it might be a case of elephantiasis, but there was no evidence of filarial infection.

**Discussion.**—If we consider malformations such as congenital dislocation of the hip, club hand and club foot, webbed fingers and other congenital deformities, in most cases we are as ignorant of the ultimate cause as of the cause of tumour growth. The relations between tumours

and malformations are very intimate, and it is hard to draw a dividing line between them. The classification of tumours is based on the type of tissue and mode of growth rather than on their ætiology, if we define a tumour as a mass of tissue growing without any regard to the laws which govern and restrain the growth of normal tissue. Gigantism, partial or universal, falls in the same group.

We understand that the complicated structure of bone is extremely sensitive to disturbances of metabolism. We know the rôle of phosphorus, calcium and magnesium salts and vitamins in certain bony alterations. We have some knowledge of the influence of hormones on the growth of bone. We know about the disturbance in calcium metabolism through loss of the parathyroid. The chromaffin system, the ovaries and testes, the thymus and hypophysis also play an important part in bone formation and growth. In acromegaly we happen to know the cause of the excessive growth, namely hyperplasia or increased activity of the anterior lobe of the pituitary gland; the bones as well as the soft parts of the face, hands and feet become greatly thickened.

In hypertrophic pulmonary osteo-arthritis, which results in elongation of the bones of the extremities, the new bone formation is supposed to be due to the absorption of some toxic substance, since it accompanies chronic lung diseases.

Apart from the malformation described above in detail, a lipoma and exostoses are present. Is the existence of three different kinds of tumours on the same extremity a mere coincidence? Exostoses are sharp outgrowths from the surface of a bone, usually recognized to be the results of fractures or of some inflammatory disease. But how are we to explain their frequent occurrence in one family and in cases where the history does not reveal injury or inflammation?

In the growth under discussion probably its cell structure is less abnormal than its excessive vigour of growth. The balance of growth between various tissues is maintained by a higher law which we cannot understand.

I am indebted to Dr. Jayaram, radiologist, Bowring and Lady Curzon Hospitals, for the x-ray examination and the report on it.

## A CASE OF DYSTROPHIA ADIPOSO-GENITALIS

By BANSIBAT DUTTA, M.B.

Howrah

S. K. M., Bengalee, Hindu, male, aged 17 years, came under my treatment on the 11th March, 1938, with the following complaints:—

(i) Gradual increase in weight, (ii) deposition of excessive fat, (iii) somnolence, and (iv) mental deficiency.

All these complaints began to manifest themselves about three years ago.

*Previous history.*—Patient suffered from chronic tonsillitis about five years ago for which the tonsils were removed. He was having nocturnal enuresis since early boyhood.

*Physical examination.*—The patient had a round face with double chin (see figure 1). There was no hair in the axillæ, pubic region and on the face. There

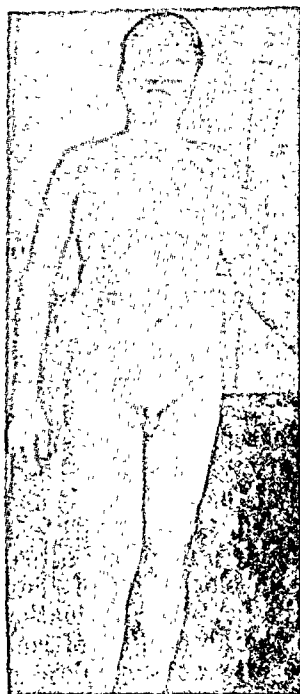


Fig. 1.—Before treatment.

was deposit of excessive fat on the breasts, anterior abdominal wall and the buttocks, which made his appearance rather feminine. The external genitals were rudimentary. The penis measured 3 cm. in length and was about the girth of the tip of the little finger. On the left side there was a small soft testis in the scrotum about the size of a pea with testicular sensation. On the right side, however, there was no testis and no sensation. The subcutaneous inguinal ring on the right side was smaller than that on the left. The height of the boy was 58½ inches. The chest and abdomen measured 33 and 34 inches, respectively, and the weight was 120 pounds.

*Provisional diagnosis.*—Dystrophia adiposo-genitalis.

*Treatment.*—The patient was given extract thyroid siccum, half a grain twice a day on empty stomach and Lugol's iodine solution, five minims twice daily, and he was kept on a diet with restriction of fat and carbohydrates. He had also milk and banana diet once a week and complete fasting once a week. Parenteral administration of the gonadotropic hormone from the anterior pituitary given every other day with increasing doses of the thyroid extract for a month and a half produced the following improvements:—The right testis descended into the right side of the scrotum, the latter becoming more roomy. Testicular sensation was present but the gland was very soft. The left one became bigger; the size was nearing that of an adult. The penis was enlarged and resembled that of an adult in shape. The hairs in the pubic region started developing. The height increased to sixty-one inches (gain in height—2½ inches), but the weight of the patient was reduced by three pounds.

The same treatment was continued, only the dose of thyroid extract was increased gradually till 4th May. It was now that the patient developed polyuria (12 to 15. times daily), the total quantity amounting to 85/90 ounces a day. The urine was examined and a

skiagram of the base of the skull was taken. The urine did not contain any sugar and the skiagram showed no abnormality of the sella turcica and the anterior and posterior clinoid processes, so that any congenital tumour of the pituitary body could be excluded.

The patient was given whole pituitrin—0.5 to 1 c.cm. every other day in place of the anterior pituitary hormone for three weeks. The polyuria disappeared.

From the 10th July an intensive course of treatment followed—anterior pituitary hormone 2 c.cm. every other day with thyroid extract, two grains twice a day for a fortnight with milk and banana diet only. There was further improvement as shown in figure 2.

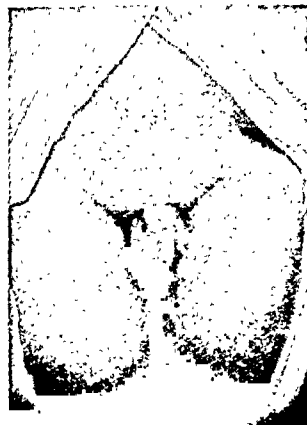


Fig. 2.—After treatment.

19th July. The dose of thyroid was increased up to seven grains daily and anterior pituitary hormone 2 c.cm. on alternate days was continued up to 11th September. The following results were noted:—Height 62½ inches (total increase 3½ inches), weight—106 pounds (total loss 14 pounds); penis—adult shape, partial retraction of foreskin, 4½ inches long. Testis—both descended, adult size and consistency, the right being smaller than the left. Face—masculine; voice—peculiarly masculine with marked personality. Hairs developed on face, axillæ and pubic region; mental condition improved. On prostatic massage and milking the urethra a little prostatic fluid was obtained.

The patient was not willing to undergo any further treatment. However, he was advised to report bi-weekly. On 5th July, 1939, the seminal fluid showed a few motile sperm cells on microscopic examination. Thereafter, the patient underwent no further treatment. The height was 64½ inches.

Points of interest in this case are:—

1. A case of this type is rarely encountered in this country.

2. It is very difficult to increase the dose of thyroid extract without estimation of basal metabolism rate. I had to stop or lessen the dose owing to the appearance of toxic symptoms, e.g., tremor, tachycardia, etc. However, it is an interesting fact that the patient could tolerate seven grains daily.

3. According to some reports the treatment is very likely to be unsuccessful in patients aged more than 10½ years owing to the fact that the testes lose the function of spermatogenesis if they are retained inside the abdomen for a long time. But this particular case has more than proved the efficacy of treatment even after this age.

# Indian Medical Gazette

MAY

## THE TREATMENT OF BURNS

It is surprising that the treatment for such an everyday domestic accident as a burn should have gone through so many changes in so short a time, yet, since the beginning of the century, the changes have been numerous and revolutionary; backward steps appear to have been taken now and then, but on the whole the progress has been forward. Some readers will perhaps remember the carron-oil period of which we still see traces in out-of-date books on first aid and domestic remedies. As we grew more sepsis-conscious this phase was followed by those of the antiseptic ointment, and then the dry dressing with the pain and tissue destruction that the usually-frequent dressings involved; this brought us to what was probably the most disastrous of all, the picric-acid dressing, which was the first-aid dressing during the last war. The only thing that could be said in favour of picric acid was that it had a slight tanning effect, but removal of the dressing often converted a first-degree into a second-degree burn, and, further, a considerable percentage of individuals were extremely susceptible to picric-acid poisoning; when this fact was once established, for several months every medical journal one picked up reported some disaster following often a simple burn, until it was recognized that this once-popular form of treatment amounted almost to malpraxis.

Wars have a stimulating effect on the study of traumatic surgery; it was not however a war, but industry that gave us the most notable recent advance: tannic acid came out of the Ford factory, literally as well as metaphorically, and it has held the field almost unchallenged for 15 years. With the present war, a slight reaction has set in, the extreme virtues of tannic acid are being questioned, some surgeons are going as far as stating that it should never be used on the face, hands, or even feet—but there is far from a general agreement on the point—and tannic acid is being supplemented and in some instances replaced by silver nitrate (10 per cent) and the dyes, gentian violet and brilliant green.

We must not however lay too much emphasis on one aspect of this subject only, for, though the first-aid dressing and the first surgical dressing are important, we must remember that it is the patient and not the burn that has the first claim to attention.

**Shock.**—It is usual to divide the shock into primary and secondary. Though this division is probably real enough, it is not one of very great practical importance. So-called primary shock is mainly psychological, and due to pain

and fear; it is likely to be less marked in the tough soldier than in the better educated officer, who knows the dangers associated with a severe burn, or in the civilian. There is also a neurogenic factor, as noxious stimuli to the skin are known to cause vasodilation, and, in practice, patients with extensive superficial burns suffer more primary shock than those with more limited deep burns. Of individuals dying from burns the death from primary shock is placed as low as 2 per cent. Primary shock will be at its height within the first two hours and the treatment is warmth and morphia, of the latter a liberal dose of a third of a grain for an adult is necessary. This initial dose of morphia is indicated even after the stage of primary shock and particularly when a patient has been travelling for some time and is badly in need of sleep. The warmth can be provided in the ways that circumstances dictate, from electric blankets to the more primitive bottles of hot water for external application, and by hot drinks or even hot coffee enemata where burns on the face and mouth make drinking painful.

It is secondary shock that claims most of the deaths due to burns, and the figure is placed as high as 80 per cent; the causes of this shock come into operation as early as two hours after the burn and operate for some considerable time, but are probably at their height within the first 48 hours. The causes, which are entirely different from those of primary shock, are the absorption of histamine-like substances from the damaged tissues and loss of plasma which exudes from the damaged surface; both tend to produce the same result, loss of plasma from the circulation, a concentration of red cells especially in the peripheral capillaries, a decrease of blood volume, and a fall of blood pressure. The tannic acid treatment is aimed at limiting the effect of both these causes, preventing the absorption of toxic substances by coagulating the surface protein, and preventing the exudation of plasma through the impermeable covering that is thus produced. In a severe burn the hæmatocrit reading may rise from the normal of about 48 per cent to 80 per cent; this means that there has been an effective loss of well over fifty per cent of the plasma, which represents a much higher actual loss, because there will have been considerable replacement from the tissues; this replacement will have had the effect of lowering the plasma protein. There is also an increase of plasma potassium. As red blood corpuscles are already in embarrassing excess, transfusion of whole blood is not indicated, nor, on the other hand, is saline transfusion, as this would lead to a further dilution of the plasma and lowering of the plasma protein. Therefore, at this stage plasma transfusions should be given, if this substance is available; if not, 6 per cent gum saline is the best substitute. Plasma transfusions present considerably fewer difficulties than do those of whole blood, for, if it is separated early, plasma



keeps for a considerable time in the fluid state, and it can be dried and preserved almost indefinitely in powder form. The other advantage is that, though grouping is necessary, the chances of obtaining a suitable plasma for a person of any particular group are much greater, for the plasma of an AB individual can be given to anyone, an O individual can take plasma of any group, and by suitable mixing of blood specimens any plasma can be made safe. Other measures to be adopted are the intravenous administration of suprarenal cortical extract or the synthetic product desoxycorticosterone acetate in full doses, to raise the blood pressure and reduce the plasma potassium. Finally, in cases of profound shock oxygen should also be given by some adequate means (and not by waving a glass funnel some inches away from the patient's face).

*Toxæmia.*—This is the next danger to which the patient is subjected, and it may come into action any time after forty-eight hours. Even in cases in which there is no sepsis there may be a considerable degree of toxæmia from the absorption of the damaged tissues, and in this tannic acid will have a considerable limiting effect. If to this sepsis is added, the toxæmia may be considerable. Tannic acid applied as a first-aid measure under favourable circumstances may prevent this occurring, but as a general rule the freedom from sepsis will depend on the first treatment that the patient receives at the surgeon's hands and on subsequent nursing. Here chemotherapy is claimed by some as an invaluable adjuvant, whereas others give it little place.

*Scarring and contractures.*—In severe burns some scarring is inevitable, but the final result will often depend to a large extent on the early treatment. It is in this connexion that tannic acid has recently come in for some severe criticism. Examples have been exhibited of crippled hands with necrosed terminal phalanges and scarred faces with ectropion, resulting, it is claimed, from the injudicious use of tannic acid. It is perfectly comprehensible that, in the case of the digits, an inelastic circle of tanned tissue might lead to cedema and eventually seriously interfere with the blood supply, but one must obviously be careful not to blame the tannic acid when it was really the original burn that caused the damage. As far as the face is concerned the eyelids should certainly not be included in the tan mask.

*First-aid.*—This will consist firstly in the prevention and treatment of the primary shock, a reassuring word to the nervous subject, a warm stimulating drink such as hot coffee, protection from cold, and an injection of morphia if the pain is severe. If there is likely to be any delay in getting the patient to hospital or other place where proper surgical treatment can be carried out, some form of first-aid dressing must be applied. What this

should be will often be a matter that is decided by what is available; the choice lies between 2 per cent tannic acid, 1 per cent aqueous solution of gentian violet, and tannic acid jelly. If the delay is likely to be long the coagulating tannic acid preparations are indicated, but if short the dye is preferable. Gauze is soaked in the tannic acid or dye solution and applied in a thick layer to the burnt area.

*Surgical treatment.*—Again shock must be given the first consideration; the badly shocked patient should receive a plasma transfusion of at least 500 c.cm. and other methods of countering shock should be applied before anything else is done. The blood pressure is the best indication of the degree of shock and of the amount of plasma loss that has to be replaced. If a burn is at all severe, an anæsthetic will be essential. Gas and oxygen anæsthesia is probably the best, but if the face is badly burnt this may be difficult, and some intravenous anæsthetic such as pentothal, up to a maximum 0.5 gramme in divided doses as the cleaning-up progresses; for the depressing effect of these intravenous anæsthetics is against their general use in cases of extensive burns; in cases where this dosage does not produce sufficiently prolonged anæsthesia, after the face has been dealt with it can be covered with gauze and the anæsthesia continued with gas and oxygen.

The whole burnt area and the surrounding skin should be cleaned with saline, soap, or if absolutely necessary ether soap can be used provided the area is washed well with saline immediately afterwards, but as a general rule antiseptics should be avoided. The treated areas are covered with a saline pack for five minutes or so, and then swabbed or sprayed with some aqueous dye solution; the best preparation is the triple dye solution—2.5 grammes of gentian violet and brilliant green and one gramme of flavine to a litre. The area is dried rapidly, if possible with an electric hair drier, and then a coagulant preparation applied. The orthodox procedure is to spray the area every half hour with a 5 per cent solution of tannic acid over a period of ten hours, but such a procedure will often put too much of a strain on the nursing staff and is further very disturbing to the patient. An alternative is to produce an immediate tanning by dabbing on a 5 per cent solution of tannic acid and 10 per cent silver nitrate alternately, until a firm tan has been produced.

There is, as we have said above, a school of thought that deprecates the use of tanning substance on the face and hands; if the whole face is burnt the eyelids should be smeared with vaseline and covered with two or three thicknesses of lint while the rest of the face is being treated, either by 5 per cent tannic acid, or simply with saline packs and dyes, if one prefers to forego the advantages of tanning in order to obviate possible dangers of subsequent



scarring, which many surgeons do not think are very real. The triple dye alone will produce a fine supple coagulum and this should perhaps be the treatment of choice for the digits.

The greatest danger of subsequent infection comes from cracks in the tan and from the junction of the sound skin with the tan covering. For this reason the edges should be well painted with the dye solution referred to above or with a 1 per cent solution of brilliant green in 30 per cent alcohol, and if there is any sign of moisture at the edges the painting should be repeated frequently. Cracks should be treated in the same way. After the tan has dried, a light dry dressing is applied and it may add to the comfort of the patient to lay the limbs on splints and bandage them lightly. The area should be inspected daily, but should not be interfered with unless the patient shows signs of toxæmia; the tan will usually separate in from ten to fourteen days.

On the place of the sulphanilamides in the treatment of burns, opinions are again divided, but the balance of opinion is in favour of their routine use. The usual dosage is employed, an initial dose of three tablets, followed by two tablets four hourly for 48 hours and one tablet four hourly for another 48 hours. Powdered sulphanilamide is also recommended for the tan-skin junctions and cracks in the tan whenever there is any sign of sepsis, or even as a routine prophylactic measure. One objection that is raised to the use of sulphanilamides is that a nourishing diet is important and that eggs are a useful item in such a diet. A liberal diet with plenty of protein is certainly essential, but for this purpose milk is preferable to eggs. Diet is undoubtedly an important factor; it should include plenty of protein to replace the lost plasma protein and the full complement of vitamins.

*Subsequent treatment.*—In the burns of the first and second degrees, after the tan separates the delicate underlying skin will require some care and it should be protected and kept soft by rubbing well with lanoline. In third degree burns the best dressing is vaseline gauze which should be kept on for another fortnight until the area is covered with healthy granulation tissue.

The subsequent treatment of the severe burn is the field of the plastic surgeon, but it should be remembered that directly the area is covered by granulation tissue skin grafting should be undertaken, or scarring and contractures will be inevitable.

## HÆMATOLOGICAL TECHNIQUE

IN the past, the attitude of the medical profession in India towards anæmia has been that it was an almost inevitable accompaniment of residence in a tropical country, and that therefore *per se* it need not claim attention. It is now beginning to be realized that when a patient is anæmic there is always some pathological process to account for the fact, and that, whilst other methods of ascertaining the nature of these pathological processes should not be neglected, much information may be obtained from the blood picture. Consequently, far more attention is being paid to anæmia itself, and the importance of accurate methods of blood examination for the proper study of a case of anæmia is gradually being appreciated.

Many books on laboratory technique give full details of all the various methods that can be adopted, but such books are not always within the reach of practitioners: further, the methods described in these books are often embarrassing in their multiplicity. We therefore felt that a series of articles on hæmatological technique would be of some practical use to readers of the *Indian Medical Gazette*, particularly those working in India. The first of these articles appeared in our February number last year, and the eleventh and last appears in the present number.

These articles describe the methods that are used at the Calcutta School of Tropical Medicine. Whilst in a few of them there are original modifications, for the most part the methods described have been well tried by workers in other countries and are accepted as accurate; in every instance, those given have been the routine methods at the School of Tropical Medicine for some considerable time, in most instances for years, and are considered by the authors to be the methods of choice for Indian conditions.

It is proposed to issue these as a series of collected papers. The booklet should be ready for issue in June. A strictly limited number only will be available, so that an early application to the publishers\* is recommended.

There is also a proposal that these articles on technique should be included in a Government of India publication on anæmia of pregnancy which will be issued later this year. As the object of this publication is to ensure uniformity in procedure in different laboratories in India, in order to facilitate comparison of results obtained in different parts of the country, the authors would welcome criticisms or suggestions by others who have had practical experience of hæmatological methods, now, so that, if they think it desirable, they may add to or modify the descriptions of technique before the final proof of this second publication goes to press.

\*The distributing agents for the publishers are Messrs. Thacker, Spink and Co. (1933), Ltd., 3, Esplanade East, Calcutta. The book, about 180 pages, bound in full cloth, with two coloured plates, will be sold at Rs. 3/-, inclusive of postage in India.

## Special Articles

### HÆMATOLOGICAL TECHNIQUE

#### PART XI

By L. EVERARD NAPIER, F.R.C.P. (Lond.)

and

P. C. SEN GUPTA, M.B. (Cal.)

(From the School of Tropical Medicine, Calcutta)

#### Red cell diameters : Price-Jones curve

**Introduction.**—In the normal blood, the red cells are not all exactly the same size, but in no individual cell does the size deviate very much from the mean. However, in some forms of anæmia the mean size of the red cells is much below the 'normal' mean; in others, it is far above it. But, in the latter case, there are nearly always some exceptionally small cells as well, so that the picture presented is that of cells of a great range of different sizes. This blood picture is best presented in the form of a curve, the abscissa being the size and the ordinates the number of times that cells of the particular size have been encountered (*i.e.*, the frequency). In the normal count, the curve rises sharply from the base line at about  $6.0\mu$  to a peak at  $7.25\mu$  and then falls almost to the base line again at  $8.50\mu$ . This graph is usually known as a Price-Jones curve. In the normal individual the shape of the curve is more constant than the mean diameter of the cells, which in a group of individuals will vary within, but rarely fall outside, the range  $6.7\mu$  to  $7.8\mu$ .

Price-Jones calculated what he called 'ideal' maximum and minimum normal curves (Price-Jones, 1933).

In different forms of anæmia this curve will vary in shape, its median will move to the right or to the left, and it may be of the normal height, or flatter than normal.

These variations in the curve can be expressed in figures. The median can be given in terms of microns, but it is more usual to give the mean corpuscular diameter (MCD), also in microns; the flatness of the curve is shown by the standard deviation ( $\sigma$ ) of the diameters of the cells from the mean diameter, or more accurately by the co-efficient of variation ( $v$ ), and also by the percentage microcytosis and macrocytosis. These data can all be calculated from the Price-Jones curve.

The measurement of cell volume percentage and calculation of the mean corpuscular volume (MCV) has been described already in an earlier paper in this series; this MCV gives the volume of the cells but not their diameter. Further, it is a 'mean' measurement and from it one gets no idea of the range of size of the individual cells; it is therefore more limited in its application than the Price-Jones curve.

Neither measurement, however, alone will give information on the thickness of the cells, but this can be calculated from the MCV and MCD. The method of making these calculations will be described later.

**The technique of the measurement of cell diameters.**—The technique described below is a modification of Hynes and Martin's method of measurement of red cell diameters.

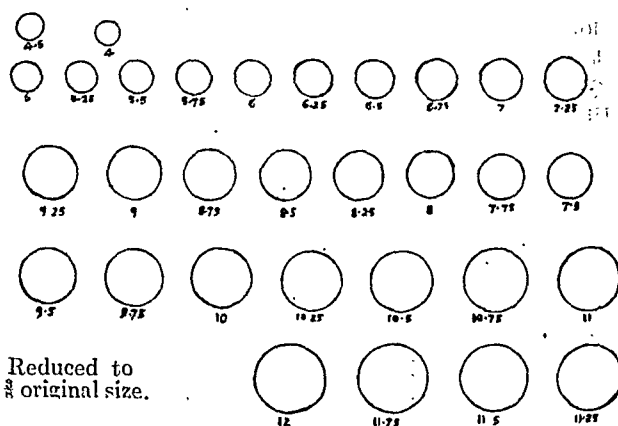
The images of the cells are projected on the vertical ground-glass screen of a Bausch and Lomb euscope, at a magnification of 2,000, and the measurements are made with the help of a celluloid protractor on which a series of circles, with diameters increasing by the equivalent of  $0.25\mu$ , have been drawn.

#### Apparatus required

- (i) A Bausch and Lomb euscope with projection screen.
- (ii) A mechanical-feed arc lamp with condenser, working at 4.5 amperes.
- (iii) A glass container filled with distilled water for cooling the beam of light from the arc lamp (filter).
- (iv) A microscope with oil-immersion objective and eye-piece to give a magnification of 2,000 on the projection screen of the euscope.
- (v) A stage micrometer scale (Zeiss) with divisions  $10\mu$  apart.
- (vi) A celluloid cm./mm. scale.
- (vii) Celluloid protractor for measuring the cells (*v.i.*).

**Preparing the celluloid protractor.**—At a magnification of 2,000,  $1\mu$  corresponds to 2 mm. and  $0.25\mu$  to 0.5 mm. The circles on the protractor are drawn with diameters increasing by the equivalent of  $0.25\mu$  (0.5 mm.), *i.e.*, the radii of the circles increase by 0.25 mm. The measurements of the radii of the series of circles are best obtained from a diagonal scale drawn to give measurements in multiples of 0.25 mm.

The circles are drawn in Indian ink with very fine bow-pen compasses on a celluloid sheet, with radii increasing from 4 mm. to 12 mm. by steps of 0.25 mm., so as to give measurements corresponding to  $4\mu$  to  $12\mu$  diameter. Circles smaller and larger than the above are drawn on another sheet. The first sheet is generally sufficient for routine work; the second is needed very exceptionally (*see figure 1*).



*Assembling and adjusting the apparatus.*—Figure 2 shows the euscope with microscope

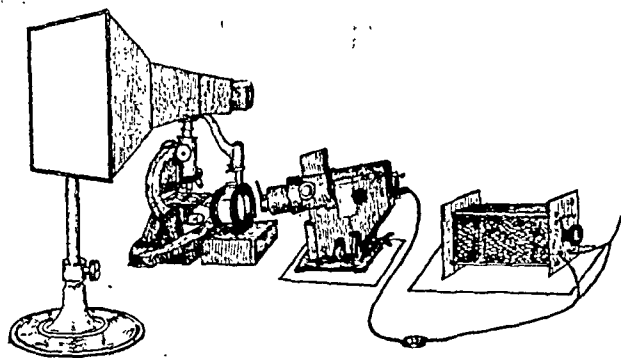


Fig. 2.

and arc lamp assembled. The concentrated beam of light from the arc lamp, cooled by passage through water in the filter, is focused on to the *concave* mirror of the microscope which reflects it through the condenser, the objective, and the eye-piece of the microscope. The total reflexion prism of the euscope placed over the ocular reflects the light on to the opaque screen of the euscope. The condenser is fully raised up, and, with the high power objective turned on, a bright beam of light is focused on the opaque screen. After the illumination has been adjusted the micrometer scale is placed under the objective of the microscope and the image of the scale is focused on the opaque screen, first using the low power and finally the oil-immersion objective. A final adjustment of light is made to give the maximum illumination. The opaque screen is now moved off and the image is focused on to the ground-glass projection screen of the euscope. By moving the microscope and/or the prism, the image of the scale is so projected that the lines of the scale are vertical, parallel and entirely free from spherical aberration, at least within an area of about 4 inches by 3 inches marked out around the centre of the viewing screen.

That there is no spherical aberration within this area can be shown by noting that the distances between the images of the lines are the same in all parts of this area. The magnification of the apparatus is adjusted to be 2,000 by using a suitable oil-immersion objective and eye-piece, and varying the length of the draw-tube of the microscope. [A Zeiss microscope with objective 90, and a Leitz eye-piece 15  $\times$ , with a draw-tube length of 154 mm. gives a magnification of 2,000 on the projection screen of the particular euscope used in our laboratory.]

To find the magnification the distance between the images of two lines of the scale is measured with the celluloid cm./mm. scale and, at a magnification of 2,000, the images of the lines of the scale are 2 cm. apart (2 cm. = 20,000 $\mu$ ). [If the different components of the apparatus are kept fixed after the above adjustments, the measurements can be carried out

without repeating these adjustments every time.]

*Measuring the cells.*—The micrometer scale is next removed, the blood film, stained with a Romanowsky stain and counter stained with 1 per cent aqueous eosin solution, is placed under the oil-immersion objective, and the image of the cell is focused on the ground-glass screen of the euscope. Only those images of the cells that fall within the reduced field are measured. The celluloid protractor with the series of graduated circles is superimposed on the image of the corpuscles to find the circle that fits the image of each cell. Each cell is measured to the nearest 0.25 $\mu$ . The measurement of circular corpuscles is quite easy. In the case of the irregular-shaped corpuscles, a circle is found such that the area of the corpuscle falling outside the circle is about the same as the area of the circle unfilled by the image of the corpuscle (see figure 3). Five hundred cells are measured

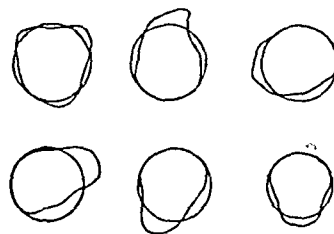


Fig. 3.

from different parts of the blood film. It is better to avoid the 'tail' end and the thick parts of the smear, as in the former the cells are excessively spread out and in the latter the cells overlap and are not well spread.

*Recording the results.*—By this method, 500 cells can be measured in about 40 to 90 minutes, the time depending on the size of the cells and the degree of poikilocytosis; the larger and more irregular the cells the longer is the time required. An assistant is needed to note down the measurements and record the number of cells counted with a counting machine of the type of a Veeder counter.

From the figures obtained, the mean diameter, standard deviation, and co-efficient of variation are calculated. A Price-Jones curve is drawn by plotting the figures on graph paper. The degree of microcytosis and macrocytosis can also be determined from this curve, by comparison with the maximum and minimum ideal curves; the overlapping of a curve beyond the minimum ideal curve on the low side and the maximum curve on the high side indicates the degree of microcytosis and macrocytosis, respectively.

*Method of calculating.*—The following figures show the method of calculating the mean cell diameter (MCD), the standard deviation, ( $\sigma$ ), and the co-efficient of variation ( $v$ ).

6.5 $\mu$ , the median, has been taken as the arbitrary mean.

TABLE I

Dia- meters in microns	Number of cor- puscles in each class (f)	Deviation (d) of each class from arb. mean, in 0.25 $\mu$ , i.e., the class interval	f $\times$ d	f $\times$ d <sup>2</sup>
5.25	4	-5	-20	100
5.50	18	-4	-72	288
5.75	34	-3	-102	306
6.00	67	-2	-134	268
6.25	74	-1	-74	74
6.50	107	0		0
6.75	70	+1	+70	70
7.00	50	+2	+100	200
7.25	46	+3	+138	414
7.50	18	+4	+72	288
7.75	5	+5	+25	125
8.00	4	+6	+24	144
8.25	2	+7	+14	98
8.50	1	+8	+8	64
			+451	
	500		+49	2,439

$n$  = total number of observations = sum of frequencies ( $f$ ) = 500.

$\Sigma f d$  = sum ( $\Sigma$ ) of the product of the frequencies ( $f$ ) and the degrees of deviation ( $d$ ) from the mean = +49.

$\Sigma f d^2$  = sum of the product of the frequencies ( $f$ ) and the squares of the deviations ( $d^2$ ).

Class interval = 0.25  $\mu$ .

Mean corpuscular diameter (MCD) =

arbitrary mean +  $\left( \frac{\Sigma f d}{n} \times \text{class interval} \right)$

$$= 6.5 + \left( \frac{49}{500} \times 0.25 \right) \mu$$

$$= 6.5245 \mu.$$

$$\begin{aligned} \text{Standard deviation } (\sigma) &= \sqrt{\frac{\Sigma f d^2}{n} - \left( \frac{\Sigma f d}{n} \right)^2} \\ &\quad \times \text{class interval} \\ &= \sqrt{\frac{2439}{500} - \left( \frac{49}{500} \right)^2} \times 0.25 \mu \\ &= \sqrt{4.878 - (0.098)^2} \times 0.25 \mu \\ &= \sqrt{4.878 - 0.0096} \times 0.25 \mu \\ &= \sqrt{4.868} \times 0.25 \mu = 2.206 \times 0.25 \mu \\ &= 0.551 \mu \end{aligned}$$

$$\begin{aligned} \text{Co-efficient of variation } (v) &= \frac{\sigma \times 100}{\text{MCD}} = \frac{0.551 \times 100}{6.525} \\ &= 8.4 \text{ per cent} \end{aligned}$$

From the mean corpuscular diameter (MCD) and the mean corpuscular volume (*vide* part IV), the mean corpuscular average thickness (MCAT) can be calculated, by means of the following formula:—

$$\text{MCAT} = \frac{\text{MCV}}{\pi r^2} \mu = \frac{\text{MCV}}{\pi \left( \frac{\text{MCD}}{2} \right)^2} \mu$$

Example.—

Let 90 cu.  $\mu$  be the mean corpuscular volume (MCV) and 6.52  $\mu$  the mean corpuscular diameter (MCD).

Mean corpuscular average thickness (MCAT) =

$$\pi \left( \frac{6.52}{2} \right)^2 \mu = \frac{90}{3.14 \times (3.26)^2} \mu = 2.69 \mu$$

The normal range of MCAT is from 1.7 to 2.5  $\mu$  (Price-Jones, Vaughan and Goddard, quoted by Whitby and Britton, 1939).

In order to calculate the percentages of microcytosis and macrocytosis, it is necessary to have 'ideal' minimum and maximum curves for the population in which the investigations are being carried out. Price-Jones calculated the 'ideal curves' for subjects in Great Britain. Working on similar lines, we (Napier and Sen Gupta, 1941) have worked out two similar curves. Two smoothed curves are shown in figure 4 and the expected frequency distributions in the ideal minimum and maximum curves are given in table II.

To arrive at the percentage microcytosis and macrocytosis, the number of cells of each size (below 6.9  $\mu$ ), in excess of the number of that particular size that appear in the minimum ideal curve, are summed; this number divided by 5, to reduce it to a percentage, is the percentage microcytosis. Similarly, the number of cells of each size (above 7.8  $\mu$ ), in excess of the number of that particular size that appear in the maximum ideal curve, are summed and divided by

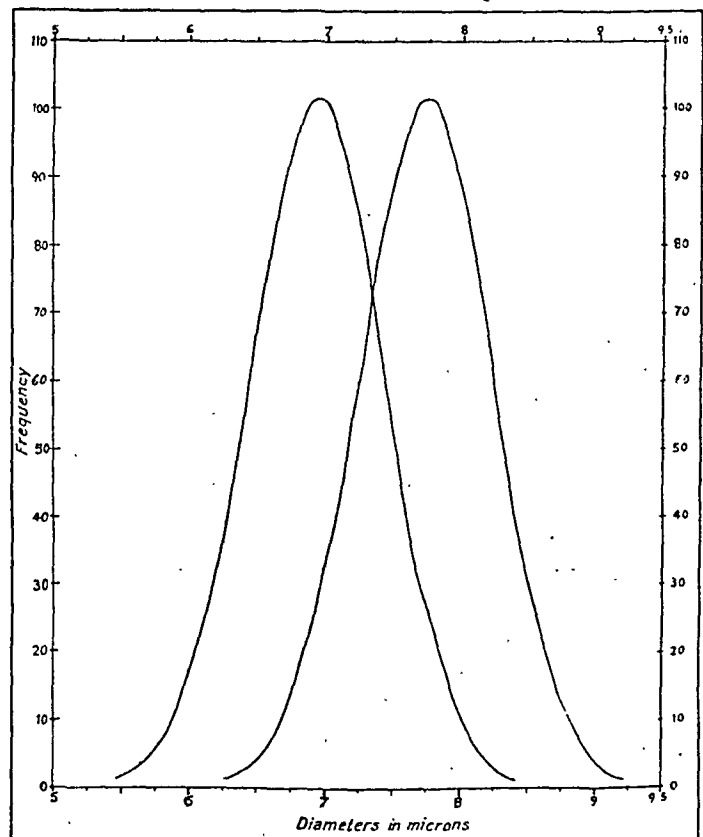


Fig. 4.—Ideal maximum and minimum curves based on Indian data (Napier and Sen Gupta, 1941).

5 to obtain the percentage macrocytosis (*vide* table II).

*Significance of the findings.*—It is not possible here to enter into any extensive discussion on

the significance of the different findings, but as a general rule it may be taken that in cases that have a high microcytosis percentage and a low MCV the anæmia is due to iron deficiency.

TABLE II

Measurement to nearest 0.25μ	Frequency distributions for		CASE X			CASE Y		
	ideal minimum curve, MCD = 6.942μ σ = 0.4925μ	ideal maximum curve, MCD = 7.747 μ σ = 0.4925μ	Count	Excess of microcytes	Excess of macrocytes	Count	Excess of microcytes	Excess of macrocytes
4.00	..	..	..	..	..	7	7	..
4.25	..	..	..	..	..	2	2	..
4.50	..	..	1	1	..	7	7	..
4.75	..	..	0	..	..	8	8	..
5.00	..	..	1	1	..	22	22	..
5.25	..	..	1	1	..	30	30	..
5.50	1	..	1	..	..	43	42	..
5.75	6	..	6	..	..	38	32	..
6.00	17	..	3	..	..	56	39	..
6.25	38	1	11	..	..	45	7	..
6.50	68	4	12	..	..	39	..	..
6.75	93	13	29	..	..	41	..	..
7.00	100	33	41	..	..	31	..	..
7.25	83	62	70	..	..	47	..	..
7.50	53	89	50	..	..	27	..	..
7.75	27	100	40	..	..	9	..	..
8.00	10	87	70	..	..	11	..	..
8.25	3	61	40	..	..	9	..	..
8.50	1	32	38	..	6	7	..	..
8.75	..	13	35	..	22	10	..	..
9.00	..	4	18	..	14	3	..	..
9.25	..	1	16	..	15	5	..	4
9.50	..	..	8	..	8	3	..	3
9.75	..	..	1	..	1	..	..	..
10.00	..	..	2	..	2	..	..	..
10.25	..	..	1	..	1	..	..	..
10.50	..	..	2	..	2	..	..	..
10.75	..	..	1	..	1	..	..	..
11.00	..	..	0	..	..	..	..	..
11.25	..	..	1	..	1	..	..	..
11.50	..	..	0	..	..	..	..	..
11.75	..	..	0	..	..	..	..	..
12.00	..	..	1	..	1	..	..	..
			500	3	74	500	196	7

Case X

Case Y

Percentage of microcytosis =  $\frac{3 \times 100}{500} = 0.6$  per cent.  
Percentage of macrocytosis =  $\frac{74 \times 100}{500} = 14.8$  per cent.  
MCD = 7.791μ  
σ = 0.903μ  
ν = 11.5 per cent.

Percentage of microcytosis =  $\frac{196 \times 100}{500} = 39.2$  per cent.  
Percentage of macrocytosis =  $\frac{7 \times 100}{500} = 1.4$  per cent.  
MCD = 6.434μ  
σ = 1.07 μ  
ν = 16.6 per cent.

Normals

	Number of observations	MEAN CORPUSCULAR DIAMETER (MCD)μ			STANDARD DEVIATION (σ) μ			Co-EFFICIENT OF VARIATION (ν) %		
		Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean
London (Price-Jones, 1933).	100	7.718	6.686	7.202	0.500	0.400	0.487	7.30	5.30	6.326
Calcutta (Napier and Sen Gupta, 1941).	25	7.747	6.941	7.344	0.643	0.341	0.492	8.84	4.58	6.720

When such microcytosis is associated with a normal, or even a high MCV, it means that the cells are thicker than normal and there is a tendency to spherocytosis; such a condition is usually found in hæmolytic anæmias. Pernicious anæmia shows a flat curve with a wide base, usually a high percentage of macrocytes and a few microcytes, whereas tropical macrocytic anæmia is usually associated with a moderately tall curve with an MCD slightly on the macrocytic side, a few macrocytes, and probably no microcytes.

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#### SCHOOL MEDICAL INSPECTIONS\*

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IN a way I am glad that the title given to this talk has been that of 'School Medical Inspections', because it gives me the opportunity of laying stress on one of the main failings of the work which has been carried out hitherto in schools in India. It has been my experience to find that school schemes are all inspection and little or no treatment. In Delhi, even now, I regret to say a scheme of this sort is still in existence in the city, where two doctors are engaged by Government to devote their entire time to the examination of all school children—at least all the boys—in all the schools in turn, and to the lamentably unsuccessful task of attempting to interest their parents in their children's ailments. No sooner have they completed one round of this breathless task than they have to start all over again to cover the ground twice in each year. Like the painters of the Forth Bridge who, no sooner having completed their job, have to start again at the other end, these doctors have no time to do anything else for their charges, or to see whether the advice given by them has been carried out. In short, there is no 'follow up' and without effective 'follow up' the mere inspection of school children in this way can have no value at all, other than the collection of data for statistical purposes. The fault in the present system is due partly to misunderstanding of the function of a School Medical Service and partly to a failure in the adaptation of the school schemes on the British model to conditions prevailing in India where the proportion of physically defective children found on inspection is as high as 70 per cent among boys and 62.6 per cent among girls. In the School Medical Services in England, children with physical defects are specially re-examined by the school medical officer twice a year and more frequently if necessary, but the number of physically defective children found on inspection there is something of the order of 15 to 20 per cent as compared with over 70 per cent in India, and therefore what is possible in England is not possible out here.

Let us for a moment recall the system in vogue in England. There under the consolidating Education Act of 1921, a duty is imposed on the local education authorities to make arrangements for the medical inspection of school children attending public elementary schools 'on their admission and on such other occasions as the Minister of Health may direct'.

It also imposes the duty of making suitable arrangements for attending to the health and physical conditions of the children. For any treatment provided under these arrangements the parents must be charged, if their circumstances permit, but no obligation is imposed on the parent to submit his child to medical inspection or treatment. In the exercise of his powers under this Act, the Minister of Health has directed that in addition to an examination of the child on admission to school, there should be a full 'routine' examination of each child at 8, and again at 12, and thereafter annually in the higher schools up to the age of 17.

Thus, routine examinations are carried out only at intervals of 3 years and 4 years in the junior classes and only become an annual feature in the comparatively small higher classes. Compare this with the schemes in India where attempts have been made to conduct 'routine' examinations twice a year. This is obviously futile and I cannot help feeling that originally a misunderstanding must have occurred and that the biannual\* re-examination of defective children was taken for the complete routine examinations referred to in the Education Act of Great Britain.

At the 'routine' medical examination in England, the parents' children are invited to attend and they are advised of the existence of any defects which may require treatment and told how best this can be obtained, either at a school clinic, or at a specialist's clinic appointed by the local authority for the purpose, or at a hospital, or by the child's own private medical practitioner. Thereafter, the children concerned are kept under regular medical supervision until the defects have been removed. In addition to this on the occasion on which the doctor (school medical officer) visits a school, he examines at the request of teachers or parents, any children which they may wish to refer to him on account of any physical or mental defects noticed by them.

My experience of the application of these principles to this country is that few if any parents will ever come to the school when the routine inspections are carried out, and that their interest in their children's ailments and their cure is not sustained. Also it is rare for the parent or teacher to refer any cases to the doctor on their own initiative, until the condition has progressed beyond the scope of the school medical officer. Apart therefore from informing the parents of the condition found and obtaining their consent to any treatment which may be required, it is impossible in India to rely on the parents to maintain their interest in their children's ailments. It is necessary therefore to arrange for the treatment and 'follow up' to be carried through the School Medical Service itself.

Nevertheless one should not be content with this arrangement. It should be recognized that the ultimate success of the school schemes based on these principles must depend on the active interest and collaboration of all the school staffs and parents. The school teaching staff in the course of their duties are afforded unrivalled opportunities of observing children's daily progress, both physical and mental, and so they are in an extremely favourable position to pick out such defects as they may develop at the earliest possible moment. If such cases are referred to the school medical officer at once and appropriate treatment instituted without delay the chances of the condition developing into serious proportions is minimized considerably.

The first duty of the school medical officer therefore must be that of establishing the most cordial relations with the school staff, to explain to them the nature and the function of a School Medical Service and to make them realize the very important part which they themselves have to play in making the service a success. Similarly the school medical officer should seek an opportunity to make similar contacts with the parents of the children for whom he is responsible and to explain to them also the functions of the

\* As biannual means 'lasting for two years' or 'appearing every two years', that is, every alternate year, might not the misunderstanding also have arisen this way.—EDITOR, I. M. G.

\* Being a lecture delivered to the Women's Medical Service Congress at New Delhi on 17th December, 1940.

service and the way in which they can be of invaluable assistance in the interest of their own children's health. What then are the functions of a School Medical Service?

- (i) Primarily, the School Medical Service is designed to provide the means for the early recognition of physical or developmental defects among school children;
- (ii) secondly, the School Medical Service should provide the facilities for the treatment of defects found, not only at a minor treatment clinic, but also by specialists, especially those in dentistry and ophthalmology, by hospitals or by medical practitioners;
- (iii) thirdly, the School Medical Service should furnish, either gratuitously or at reduced rates, the means for providing spectacles for children who cannot afford them;
- (iv) fourthly, the School Medical Service should include special schools or classes for backward children, for enfeebled children, for the blind, deaf, dumb, tuberculous, epileptic, crippled or debilitated children;
- (v) fifthly, the School Medical Service should include arrangements for the provision of additional meals (e.g., milk) for ill-nourished children;
- (vi) sixthly, the School Medical Service should arrange for the protection of children and school staff against disease by vaccination and inoculation.

These arrangements demand the co-operative and co-ordinated effort of local administration in the health department, school medical officers, hospitals, specialists, school authorities, parents, and medical practitioners.

In addition to the organization and supervision of the Service on these lines, the school medical officer has other duties which are frequently forgotten, namely:—

- (i) He should advise on school closure when this is indicated by the outbreak of infectious disease;
- (ii) he should control the exclusion from school of cases of contacts of infectious disease, and pay home visits;
- (iii) he should ascertain through home visits the cause of absences, frequent or prolonged, of children from school and of recurring physical conditions which may be attributable to domestic circumstances;
- (iv) he should advise on the suitability of school premises, and on the adequacy of sanitary and drinking water arrangements;
- (v) he should be responsible for the lighting arrangements in class rooms, particularly on desks and black boards, both natural and artificial, and study their effect on the causation of eye strain;
- (vi) he should advise on school furniture and study the effect of such furniture (i.e., desks) on posture;
- (vii) he should advise on the type and paper provided in textbooks used by the school children;
- (viii) he should advise on the schemes of physical exercise and on the organized games prescribed for the children;
- (ix) he should take a lively interest in the personal hygiene of the scholars and of the teachers.

The translation of these principles into practice is by no means always an easy matter. The main difficulty usually lies in the geographical position of the schools concerned. It would obviously not be economical to provide a clinic and a school medical officer for every little school. On the other hand, the maximum number of children which one school medical officer can reasonably be expected to look after cannot be more than 2,500.

An important practical point is that a scholastic year only gives one 190 working days on an average, and that there are only five working hours on each one of those days. Now with good organization the maximum

time for a 'routine' examination is ten minutes for an expert, and no school medical officer should be expected to carry out more than 15 routine examinations a day. Thus, 150 minutes or 2½ hours are taken up by routine examination leaving 2½ hours which should be devoted for the examination of referred cases and for the 'follow up' and treatment of those found physically defective. At this rate the maximum number of children a doctor can examine in one year is 2,850, but as we have seen the school medical officer has many other duties to attend to and it would be safer therefore in the interests of efficiency to aim at a maximum of 2,500.

Where the schools concerned happen to be large schools grouped closely together as is the case in the municipal boys and girls schools in New Delhi, the problem is very much simplified, because a central clinic can be provided for all the schools with a whole-time school medical officer in attendance. These are ideal conditions.

On the other hand, when the schools are scattered the problem is much more difficult of solution. The following alternatives are then open to us:—

- (a) The grouping of schools on a regional basis to be served by a clinic situated geographically as centrally as possible; or
- (b) the clinic-in-every-school system.

In the former system each school has a compounder in immediate charge of it and working under a school medical officer who goes round the schools in turn. The compounder is responsible for carrying out, at the clinic or at school if possible, the day-to-day minor treatment prescribed by the medical officer. 'Routine' examinations are carried out in each school itself so as to interfere as little as possible with school routine. The number of schools must be limited by the number of scholars and the S. M. O. must visit each one in turn at least once a week. A scheme on these lines is contemplated for 10 schools in Delhi City with a total population of nearly 20,000 pupils.

In the second system there is a small clinic or dispensary in each school and no central clinic. A nurse is employed to visit two schools every day and to carry out the minor treatments prescribed by the doctor, who, in turn, visits each school once a week. There is a scheme of this sort in existence in Delhi City. It is maintained by the Delhi Health Society, who serves 10 girls' schools with a total population of 2,470 children and costs Rs. 1,678 (*plus* doctors' fees).

One has to admit that the central clinic scheme, unless ideally situated relative to the schools, as it is in New Delhi, is not suited for girls in India and it is probable that there will be some difficulty about attendances at such clinics even in the case of the boys. This is one of the reasons for which the compounder is employed so that the scholars may be shepherded for treatment or examination. If the schools are not grouped conveniently together in the same compound, then the best system for a large number of girls' schools is the Delhi Health Society scheme I have described.

In the rural areas the problem presents even greater difficulties owing to the scattering of the schools, poor communications and inadequate staff. As things are, the doctors attached to rural dispensaries can only get round to each school about twice a year, or at best once a quarter. This is obviously not enough for either adequate supervision or care. The only hope therefore lies in the training of school teachers in the recognition and simple treatment of minor ailments by the use of first-aid boxes by suitable courses at normal teacher's training schools.

The Education Act in England demands that the parent pays for any treatment received if he can afford it. In India the principle is that 2 annas per head per scholar may be charged from scholars in the middle and higher schools or classes. Where primary education is not compulsory there is no legal objection to the fees being paid by children attending primary classes. I have little doubt however that it will be impossible to make a School Medical Service, properly organized and equipped, pay for itself at the rate of 2 annas per



head. But this fact need not deter any one. The local authority must be made to realize the importance of the School Medical Service as a means of ensuring the

health of their future citizens, and that authority should be prepared to bear such balance as may be required, as an insurance for the future health of the nation.

## Medical News

### ASSAM PROVINCIAL MEDICAL RESEARCH CONFERENCE

THE first annual Assam Provincial Medical Research Conference, held in Shillong on 31st March, was presided over by Dr. L. Everard Napier, Professor of Tropical Medicine at the Calcutta School of Tropical Medicine. Dr. Napier, in his opening address, gave a short account of the important medical research activities in Assam during the last 50 years.

A number of important papers were read at the conference; these included papers on typhus fever in Assam and the bacteriology of diarrhoea in Shillong by Captain Woodhead. The former disease was, he said, far more common than was usually suspected, and he added that the blood of all cases of doubtful fever should be sent to the Pasteur Institute for testing for typhus fever—this would be undertaken free of cost.

Dr. Viswanathan read three papers on malaria; the one that raised the greatest interest was on the control of malaria by spray-killing of adult mosquitoes. There are great possibilities in this measure for the individual protection of people living in highly malarious places.

Dr. Hare read an interesting paper on anæmia, and the chairman, Dr. Napier, concluded by giving details of a very important advance that has been made in the treatment of kala-azar, by means of a drug of entirely different composition from any that have previously been used in the treatment of this disease. He had treated, up to date, 30 cases with excellent results in each instance; many of these patients had hitherto proved resistant to treatment with urea-stibamine and other antimony preparations.

This paper led to an interesting discussion, particularly on the question of urea-stibamine-resistant cases of kala-azar that have been reported in Assam. This drug seemed to provide a good answer to this problem.

At the conclusion of the conference, the chairman said that, as this first conference had been a great success, he hoped that it would be possible to hold such a conference each year. He suggested that a little earlier and wider publicity might be given for the conference next year.

#### *The chairman's address*

Dr. Napier, in his opening address, apologized for not presenting an address really worthy of the occasion, but explained that he had only been asked to take the chair since he had arrived in Shillong. Dr. G. C. Ramsay, who was to have presided, was unable to interrupt his tour programme. To give an adequate account of the medical research work that had been done in Assam, Dr. Napier said, it would be necessary to turn up the earlier volumes of the *Indian Medical Gazette*, the *Scientific Memoirs* of the Government of India, and other official publications that appeared before the *Indian Journal of Medical Research* and its offspring, the *Journal of the Malaria Institute of India*, but as he had neither the time nor the opportunity to do this he would have to speak from notes written from memory. He continued:—

'Some of the earliest research work done in the province of Assam was in connection with kala-azar. In the eighteen nineties, the second great kala-azar epidemic occurred in Assam; its focal centre was Nowgong, a point which the previous epidemic had not reached. In those days nobody knew what the disease was—whether it was a severe form of malaria or a disease *per se*? The research giants of those days, Ross and Rogers, each came up to investigate it and each went away defeated. They both believed that it was a particular form of malaria.

'Colonel Giles, an I. M. S. officer who also investigated the disease, thought that it was caused by hookworms, and Dr. Bentley, who was against the malaria theory, was misled by a positive agglutination test and suggested that it was a malignant form of Malta fever. Rogers with the help of Dodds-Price, whom many of you will remember, formulated measures of prevention which even to-day, with our knowledge of the way the disease is transmitted, are the only measures that one could suggest, namely, complete destruction of *lines* and removal to a new site.

'That epidemic subsided, leaving behind its trail of endemicity but no light as to the nature of the disease that had withdrawn itself. In 1903 the causative organism of kala-azar was discovered and in 1915 the first specific treatment for the disease was introduced; Rogers and Muir demonstrated its relative efficacy in Bengal and Dodds-Price in Assam, so that when the next epidemic started in 1917, this time higher up the valley in Sibsagar subdivision, we were at least armed with the knowledge of what the disease was and how it could be treated. But I must not concentrate on kala-azar.

#### *Pasteur Institute*

'In 1916, an important event in the history of medical research in Assam occurred; the Pasteur Institute was opened. This event was an important one to me personally, because it gave me my first independent job in India and coincided with an important geographical discovery—I discovered that Shillong and Ceylon were two separate places and a long way from one another.

'I was at the time understudying Captain Knowles (who had just returned from Mesopotamia where he had been wounded at the battle of Ctesephon) at the Cumbala War Hospital in Bombay, where he was bacteriologist. Knowles was selected as the first Director of the Pasteur Institute of Assam and some of you will perhaps remember the boundless energy that Knowles put into any job he undertook. War or no war, he managed to get that institute on a sound working basis, not only as a Pasteur Institute but as a research centre. Knowles remained in Shillong for nearly four years and was then selected by Sir Leonard Rogers to organize the School of Tropical Medicine in Calcutta.

'The germ of the idea of starting such a school in the tropics originated in the mind of Dr. Winchester, a tea-estate medical officer whose name is still revered in Assam; once started in the mind of Sir Leonard Rogers, the idea materialized very rapidly. Rogers was, and still is, a fighter, and the official difficulties only stimulated him to greater efforts; but it was only through the help of the big European industries—tea, jute and mining—that he fought and eventually won over the officials and founded his school.

'Rogers looked upon Assam as one of his main fields for clinical and other investigation and that tradition is still maintained at the school.

'To return once more to kala-azar.

#### *Pre-antimony days*

'Dr. Ramsay remarked at the annual general meeting of the British Medical Association last week that it was hard for the younger men coming out to practise in the tea districts to realize what conditions were like 28 years ago, when he first came out. He was not thinking of kala-azar, because he did not see it in his district. I admit that my association with Assam does not date back to the pre-antimony days, for I first

came to Assam in 1919, but I had plenty of opportunity of discussing the subject with men who had recently had the distressing experience of being powerless to do or suggest anything in the face of a diagnosis of the then fatal disease, kala-azar.

'To them, and to all of us in those days, the discovery of intravenous antimony tartrate seemed little short of a miracle. Yet a few years later, this same treatment had been put so far into the shade by the newer forms of treatment that it was almost looked upon as malpraxis to give the trivalent salts of antimony when one of the efficient pentavalent compounds was available.

'Though the organization for the wholesale treatment of kala-azar in Assam that undoubtedly helped to check the 1917 epidemic, originated by McCombie Young and Taylor, was based on the trivalent salts, the great success of this measure would never have been achieved without the brilliant chemotherapeutic investigations of Professor Hans Schmidt and his enterprising followers in this country, notably Sir U. N. Brahmachari. So much for the treatment of kala-azar and the part that Assam workers have played in establishing it, for the time being at any rate, as I shall have a little more to say on the subject during this morning.

#### *Sandflies suspected*

'The last epidemic of kala-azar was subsiding before we were able to get any definite information as to how the disease was transmitted from one person to another. Colonel F. P. Mackie who succeeded Knowles at the Pasteur Institute and had worked on kala-azar in Assam before the last war, always suspected sandflies, and as early as 1921, I remember helping him to catch, dissect, or rather squash, and examine many specimens in Nowgong, but we were unlucky, in that we were, I believe, only catching *Phlebotomus minutus*, a variety that lived mainly on lizards. The discovery of the development of leishmania in the silver-footed sandfly, *Phlebotomus argentipes*, was not made until three years later at the Calcutta School, mainly as a result of epidemiological investigations in Calcutta which showed that the disease was confined largely to one particular quarter of the town where conditions were particularly favourable for this sandfly and where we found it abounding.

'The kala-azar commission, under the auspices of the Indian Research Fund Association, followed this line of work and carried matters much further. The commission worked first at Golaghat and then at Gauhati under the directorship of Sir Rickard Christophers, Colonel Shortt, and, for about a year, myself, and eventually the remains of this commission, now lowered to the status of an enquiry, was transferred to Calcutta under my charge. When in 1934 the enquiry was eventually closed down, the position had been reached that kala-azar was almost certainly transmitted by the sandfly, *Phlebotomus argentipes*, but we had not found out the trick of how transmission could be effected with certainty. Many infected sandflies had been found in nature and a few infections had been transmitted to hamsters by the bite of this sandfly, but against this there were many failures, and the complete failure to transmit the disease to human volunteers.

#### *Natural immunity*

'Dr. R. O. A. Smith, who worked with us in Calcutta, has again taken up work during the last two years. Smith has a way with sandflies that nobody else seems to possess and he has now succeeded in making them transmit the infection almost at will; he has done this by giving the flies feeds, subsequent to the infecting feed, on fruit juice, so that the infection is not suppressed by subsequent blood meals; the fly becomes so heavily infected that it cannot suck blood properly, until it has, so to speak, coughed up a large plug of flagellates into the wound its proboscis has made.

'The conditions of this experimental transmission are such that would occur in nature, and I myself do not feel that that the human experiment is necessary

to complete the case against this sandfly; for man enjoys a high degree of natural immunity.

'The real problem is to devise means of controlling this sandfly in nature, and I am glad to be able to tell you that Dr. Smith is again coming to work in Assam on this very problem.

'The only further advance that I myself can visualize, except in the matter of sandfly control, is that it may be found that some special fruit or plant provides an exceptionally favourable meal for the sandfly, or exceptionally favourable medium for the growth of leishmania in the sandfly, and that the distribution of this plant, as well as that of the sandfly, may determine the distribution of kala-azar, for there are still some anomalies in this direction to be explained.

#### *Malaria*

'Whilst kala-azar was attracting the attention of the health authorities, the really far more serious disease, malaria, was being accepted as something that was inevitable. It was the tea-estate medical officers who first made a stand against this attitude.

'I won't attempt to recount the beginnings of anti-malaria work in Assam or to apportion the credit, but the name that sticks out in this connection is that of Dr. G. C. Ramsay, and nobody could deny that Dr. Ramsay with his dynamic personality has been, and to-day still is, the greatest enemy of the malaria-carrying mosquito in Assam—not to mention many other parts of India.

'As a tea-garden medical officer he introduced new principles into the subject of malaria control and put these principles into practice on his own gardens with the brilliant success that you all know, and since he joined the Ross Institute he has diffused his special knowledge and infused his enthusiasm throughout the tea districts in Assam and much further afield. No more fitting chairman could have been chosen for this Conference, and I feel that my occupation of this chair, through Dr. Ramsay's inability to interrupt his programme, is somewhat of anti-climax.

'In mentioning Dr. Ramsay in connection with anti-malarial work in Assam I know that I am on safe ground, but, even at the risk of omitting more important names, I do not feel that I can close this subject without mentioning the work of Manson at Cinnamara, Fraser at Labac, and Lamprell at Nazira, for with all three I am personally very well acquainted and at the headquarters of the two former I have spent many interesting weeks.

'Nor must I omit to mention Colonel Morison, whose efforts started the Assam Research Society, and Dr. Rice with his native hustle, whose work on malaria in particular did so much to justify this enterprise.

'The mention of Colonel Morison inevitably brings one to bacteriophage. Whether I am wise in mentioning this subject I do not know. I usually place bacteriophage with religion, as a dangerous subject of controversy, but it certainly had its day in Assam, as it has had nowhere else. Perhaps one day Colonel Morison will be hailed as prophet; perhaps not; history will decide.

#### *Another great scourge*

'After malaria, bowel diseases are Assam's greatest scourge, and this is a group of diseases in which the last twenty years has seen great changes occur, but not as a result of bacteriophage or any other form of treatment. The answers to this problem were known to us all; they were water supply and sanitation. In the gardens where a good water supply has been established, the battle has been half won; when a satisfactory latrine system has been established, bowel diseases will cease to be a serious problem. And with the bowel diseases hookworm infection will also go. Though I do not want to dwell on another of my pet subjects, I believe that the debilitating effect of hookworm anaemia is not sufficiently realized.

'The amount of valuable research work that has been done in Assam in the past is very considerable, and the opportunities for further research are enormous.

The microscope and the well-equipped laboratory are valuable tools for the research worker, but they are by no means essential. The basis of all research work is accurate records of observed facts, whether they are observed clinically or through the microscope. The inaccuracy of vital statistics in India is the greatest handicap to both research work and public health administration in this country. In tea-garden practice, there is a wonderful opportunity to supply this deficiency and I believe that Dr. Lamprell and those who have laboured at standardized returns for tea estates have done a great service, not only to the tea industry but to the province as a whole.

#### *The genesis of the Conference*

'Before concluding, I must say a little about the genesis of this conference.

'The suggestion originated with Major Hamilton whose work on the eye-fly is the outstanding piece of research carried out in the tea districts during the last few years, in his presidential address at the annual general meeting of the British Medical Association in 1939.

'His suggestion was that the Inspector-General of Civil Hospitals should organize this Conference. The subject was again brought up at last year's annual meeting and Colonel Phipson, whilst strongly in favour of such a conference, thought that it would be better if it were organized unofficially; he promised it his official blessing.

'The obvious organization to initiate such a conference was the British Medical Association, and the Council on behalf of the Assam and North Bengal Branch of the British Medical Association undertook this initiation, agreed to bear the expenses connected with it, and to allow their honorary secretary, who very kindly volunteered, to undertake the secretaryship of the first conference.

'This conference therefore, though initiated by the Assam and North Bengal Branch of the British Medical Association, is in no sense a conference of that body, but any one doing research work in the province, or on any subject that is of vital interest to the province, was welcome to read a paper at the conference, and attend and join in the discussions. A circular announcing the conference was sent to the Inspector-General of Civil Hospitals, Assam; Director of Public Health, Assam; the Assam Medical Research Society, Dr. Ramsay for the Ross Institute, the medical officers in charge of the laboratories at Cinnamara, Labac, Juri Valley and Nazira; the chief medical officer, Assam Bengal Railway, Dr. Hydicks for the Rockefeller Foundation, Dr. Muirhead Thomson at Tocklai for the London School of Tropical Medicine, and to myself for the Calcutta School of Tropical Medicine.'

#### CINCHONA CULTIVATION AND THE MUSTARD OIL PROBLEM IN ASSAM

A QUESTION of great importance, not merely to Assam but to India as a whole, was discussed in the Assam Legislative Assembly on Tuesday, the 18th March last, when Mr. Baidyanath Mookerjee moved a cut motion in the House under the demand for grants for forests to criticize Government for not adopting necessary steps for cultivation of cinchona in the province.

It is understood that Mr. Wilson, the expert on cinchona cultivation, who visited Assam also, had expressed the opinion that many areas in Assam were suitable for cinchona cultivation. This shows that if this cultivation had been taken up not only that Assam would not have to import cinchona products from outside the province but probably Assam could supply this commodity to other parts of India.

Mr. Baidyanath Mookerjee in moving his motion said that on many occasions they had raised this point and Government gave their customary reply that 'this matter was receiving their serious attention'. He pointed out that the Hon'ble Premier gave such a reply last year during the budget session when

Mr. Nirendra Chandra Dev raised this question, but this year nothing has been provided in the budget for cinchona cultivation. Bengal Government, he pointed out, had tried this near about Darjeeling and they found it quite profitable, but Assam Government was still waiting. He was told that though Assam Government's experiment at Nongpoh had proved successful, yet it was still in the experimental stage and nothing had been done to increase the area and thereby to save money of the province and to increase the resources of the province. On the other hand Government had budgeted for 15,000 lb. of quinine from Java through the India Government, over and above their usual requirement of quinine.

Dr. C. G. Terrell, who was sworn-in only the day before, made an admirable maiden speech stressing the importance of this drug in the treatment of malaria and requesting the Government to support the project for an increase in cinchona cultivation in the province. He said:—'I am well aware that the price control of quinine is not primarily the concern of the Assam Government, but I would like to suggest that our moral obligations to the community make it most desirable that its influence should be exercised with the Central Government in this matter.

'Over the pre-war price of quinine there has been an increase of 68 per cent in India Government quinine and 48 per cent in the price of the Java product.

'I am unable to offer any explanation for the discrepancy which exists in these figures and why India Government quinine should have increased in price so much more out of proportion than that of Java. It would appear that this increase is unjustifiable.

'The result however must be that the price of this essential drug is beyond the means of the poorer sections of the community and that it has added an additional financial burden to hospitals and industry.'

*Minister's reply.*—Mr. Rupnath Brahma, Minister, Forests, Assam, in replying to the motion said:—'Mr. Wilson who is an expert on cinchona cultivation had toured throughout India and he came to this province also to make an enquiry and see whether there are lands available and suitable for cinchona cultivation in this province. He submitted a report on the subject in which he recommended some of the areas here in our province. That report had been very lately referred to our Forest Department and unfortunately for that delay we could not include in the present budget any regular scheme for this cultivation. However, I am glad to inform the Hon'ble Members that the areas have been selected in the Khasi and Jaintia Hills according to the recommendation made by Mr. Wilson. Really this will be a great step in the plantation programme. We have placed orders for seeds and I think those will be sufficient to plant up in some of the areas which we have selected. I am glad to inform the Hon'ble Members that in the Khasi and Jaintia Hills at least we are going to have some more cultivation from the next year. I also hope to bring a regular scheme before this House next year. I hope with this the Hon'ble Member will see his way to withdraw the motion.

On the above assurance the motion was withdrawn by the mover.

Supporting another cut motion Dr. Terrell drew attention to the defects of the Assam Pure Food Act, and the difficulties that existed in the application of its provisions.

He said 'A very important example of this is evidenced by the mustard oil problem. Research work in this connection—with which I had the privilege of being associated at its commencement—has been in progress in this province and elsewhere for more than six years. The findings have all been recorded by workers at the All-India Institute of Hygiene and at the School of Tropical Medicine in Calcutta in the *Indian Journal of Medical Research* and *Indian Medical Gazette*.

These investigations go to prove beyond doubt that mustard oil is frequently contaminated by more-or-less harmful adulterants, and that one in particular, namely

*Argemone mexicana*, is primarily responsible for the disease known as epidemic dropsy.

Unless it assumes epidemic form this serious disease—with its crippling and sometimes fatal sequelæ—is often difficult to detect. I am however of opinion that in a less acute and more chronic form it is very common, and apart from epidemics, is the probable cause of a serious amount of ill-health and disability.

Argemone contamination of mustard oil is more the result of careless cultivation than wilful adulteration, for the reason that the plant grows freely with the unweeded mustard crops—with which it is cut and gathered, and the seeds closely resemble those of the black mustard variety.

The results to the unfortunate consumer are nevertheless the same, and if, for a brief moment, our minds can attempt to visualize the enormous quantity of mustard oil—frequently contaminated—that is consumed daily by all classes of the community the danger will become apparent to all.

In the light of our present knowledge I venture to suggest—Sir—that the time has come for the introduction of amended legislation to prevent the sale of Argemone-contaminated mustard oil, so as to reduce epidemic dropsy from the status of a major public health problem to that of an interesting pathological curiosity.

It is my belief that this is impossible of achievement by the Assam Pure Food Act, with its many working imperfections; on those occasions when contaminated samples of this oil are located the average individual shrinks from the irksome and unsatisfactory processes laid down for bringing the matter to the notice of the authorities, and even when this is done the results are usually not deterrent to the unscrupulous vendor.

The best methods for achieving a solution of this problem by legislation could far better be propounded by those more experienced and competent to do so than myself.

In certain countries these difficulties have been overcome by Noxious Weed Acts and similar measures, which ensure a crop free from the trespass of dangerous plants and weeds.

I further venture to suggest, Sir, for possible consideration that the mustard oil industry in this province should be directly under the control of Government and the oil sold under licence as in the case of country spirit.

The additional source of revenue to Government could compensate them for the necessary expenditure and place the cultivation, manufacture and sale of this very important commodity on a wholesome and hygienic basis.

They would then have the satisfaction of real achievement and the community would feel assured that when making their purchases whether large or small they could do so without the present fear that it is probably of inferior quality, contaminated with dangerous adulterants injurious to their health. I must apologize for having possibly taken up too much of the valuable time of the House, but it is certain that proper, thoughtful and efficient legislation on this subject would be of lasting benefit to the health and welfare of all in this province.

#### ARGEMONE MEXICANA

At the annual meeting of the Assam branch British Medical Association, held in Shillong towards the end of March, Dr. C. G. Terrell addressed the meeting on the subject of this plant.

He informed them that certain matters of importance had come to his notice as the result of information passed on to him by Lieutenant-Colonel W. D. Ritchie, I.M.S. (retd.), relating to botanical features of the development of this plant in Upper Assam.

The mustard plant, *rai* or *maghi*, in Upper Assam ripens in the month of January at a time when the

argemone plant is not yet mature. The argemone plant ripens and its seeds reach full maturity at least two months later—in March and April.

The mustard crop is therefore harvested and off the ground long before the noxious weed matures.

This would appear to present—for the first time—a satisfactory explanation of the fact that epidemic dropsy is comparatively very rare in Upper Assam and also by inference provides further valuable evidence in support of argemone contamination of mustard oil as the cause of epidemic dropsy.

In the Surma Valley and Bengal, besides the *rai* there is a slower-growing, taller and stronger plant called *shorsia* which matures later and approximates to the time of ripening of the argemone plant. This crop (of rape) is cut by sickle and not uprooted by hand, as in the case of the short mustard grown in Upper Assam.

From this it is easy to visualize how the seeds of the two plants—which ripen simultaneously and whose seeds much resemble each other—can become mixed when threshed together.

#### MANUFACTURE OF DRUGS

##### INCREASING USE OF INDIGENOUS RESOURCES

BORIC ACID for the Medical Stores Department, hitherto obtained from England, may shortly be manufactured in India. It is proposed to purchase crude borax, imported from Tibet, and arrange for the manufacture of boric acid. Another imported article, tablets of magnesium sulphate, 40 grains, is being manufactured by one of the Medical Stores Depots.

Peptone powder, used as a culture medium, has hitherto been obtained from England. It is now manufactured in India. A sample has been tested by the military laboratories and found to be a suitable substitute for the imported article. Accordingly it has been transferred to the list of indigenous articles.

Arrangements are being made for the manufacture of arsenii tri-iodidum in the country.

#### DRIED ONIONS

WITH the substitution of dried chipped potatoes in the soldier's ration, further research has revealed the possibility of using dried onions in lieu of fresh ones.

As about 12 maunds of fresh onions yield about one maund of dried onions, there will be a saving in transit and storage. It is claimed at the same time that dried onions keep a long time and do not become rotten so quickly as fresh ones. They take considerably less time to fry and can be boiled in two or three minutes. As they are already cut and prepared ready for cooking, they will reduce the time required for the preparation of dishes.

#### INDIAN MEDICAL COUNCIL

In exercise of the power conferred by clause (a) of sub-section (1) of section 3 of the Indian Medical Council Act, 1933 (XXVII of 1933), the Central Government is pleased to nominate Colonel H. Stott, O.B.E., M.D. (Lond.), F.R.C.P. (Lond.), D.P.H. (Eng.), K.H.S., I.M.S., Surgeon-General with the Government of Madras, to be a member of the Medical Council of India, from Madras, with effect from the 17th March, 1941, *vice* Major-General N. M. Wilson, I.M.S., resigned.

In exercise of the power conferred by clause (a) of sub-section (1) of section 3 of the Indian Medical Council Act, 1933 (XXVII of 1933), the Central Government is pleased to nominate Lieut.-Colonel S. L. Mitra, B.Sc., M.B., Ch.B. (Edin.), D.T.M. & H. (Edin.), D.P.H. (Edin.) and (Glas.), I.M.S., Officiating Inspector-General of Civil Hospitals, Bihar, to be a member of the Medical Council of India, from Bihar, with effect from the forenoon of the 21st March, 1941, *vice* Colonel H. Stott, I.M.S., resigned.

## Current Topics

### Acute Appendicitis in Children: A Clinical Study of more than 1,000 Cases

By E. M. MILLER, M.D.

E. H. FELL, M.D.

C. BROCK, M.D.

and

M. C. TODD, M.D.

(From the *Journal of the American Medical Association*, Vol. CXV, 12th October, 1940, p. 1239)

THERE is probably no one subject in the entire field of surgery that has aroused more widespread interest among the public and the members of the medical profession than that of acute appendicitis and its complications. Yet the very fact that at this session the American Medical Association is devoting a symposium to this topic, even though more than half a century has elapsed since the pioneer work of Reginald Fitz, seems proof enough that there remains a good deal of uncertainty, at times, as to methods of management of the patient with appendicitis. Much progress, nevertheless, has been made and is being made, especially as the result of careful clinical studies in large series of cases. Too often, however, papers have been written on evidence obtained by a review of hospital records rather than from personal observation of patients, and therefore the conclusions drawn have sometimes not been as reliable as they should be. Too often, also, statistics have been published as to the effectiveness of treatment without clear differentiation between perforations of the appendix which clinically have remained localized (with a definitely palpable mass) and those which have obviously involved the open peritoneal cavity.

We submit here the result of what we consider a careful personal clinical study of well over 1,000 cases of acute appendicitis and its most frequent complications observed by us at the children's surgical ward of the Cook County Hospital, Chicago, during a little more than four years, hoping that from it certain conclusions may be drawn which will be helpful in clarifying the still existing uncertainty as to reliable indications for and against operative intervention.

#### CLASSIFICATION AND TREATMENT

During the past twenty-odd years of surgical practice it has gradually become apparent to us that, from a clinical point of view, patients with acute appendicitis and its most common complications, whether children or adults, fall naturally into one of three fairly clear-cut, fairly well-defined groups, and we feel that it is highly important for one to decide, or at least to attempt to decide, into which of these each patient belongs, as this decision may materially influence the course of treatment.

**GROUP 1.**—This group comprises all patients who are obviously suffering from an attack of acute appendicitis before the stage of perforation. It seems hardly necessary here to elaborate in detail either on the usual 'textbook' picture or on the difficulties that may arise in making a diagnosis when the atypical case is encountered. Suffice it to say (for the purpose of this discussion) that we believe it to be the consensus to-day that appendectomy as soon as the diagnosis is made is the treatment of choice, except for those patients in whom the attack is definitely subsiding. In our study there were 629 patients in this group, all of whom were successfully operated on without a single death. Would that every patient when first seen by the surgeon could be included in this group.

**GROUP 2.**—In this group a longer duration of symptoms is noted. The characteristic clinical observations are obviously those associated with a perforation of the

appendix against which there has been set up from the time of perforation an adequate local defensive mechanism. A careful history will usually show that the patient has been sick for several days, perhaps a week or ten days or even longer. He does not as a rule appear desperately ill. The fever may be fairly high and the leucocyte reaction well marked, but he does not have an anxious expression, nor is he suffering intense pain. On abdominal examination with the patient relaxed and the thighs held in flexion, one can make out by palpation the margins of a definite mass, varying in size from that of a walnut to that of an orange or perhaps even a small grapefruit and varying considerably also in position. Though it usually occupies the right lower quadrant, it may be felt well into the right flank; sometimes it is in the left lower quadrant, and not infrequently it is deep in the pelvis, where it can be made out only with the finger in the rectum. Occasionally it is so deeply situated in the main abdominal cavity and so covered by large tense abdominal muscles that its presence is made certain only after complete relaxation induced by an anæsthetic, and in extremely rare instances it may not be discovered until after the incision has actually been made and the walled-off process seen with the naked eye or felt with the examining finger. The point we wish to make is this: Whatever its size, whatever its position and however its presence may be detected, it represents pathologically a slow leak from the appendix, which has become effectively sealed off from contact with the open peritoneal cavity.

As to the treatment of the patient in this group, we are well aware that there is still a considerable difference of opinion even among competent surgeons. Many feel that the majority, if not all, of these so-called appendical abscesses should be drained early, and some even go so far as to advocate a serious attempt at removal of the appendix at the same time. With this attitude we cannot agree; such a policy is neither safe nor necessary. It is not safe, because, if between the wall of that palpable mass and the parietal peritoneum there are normal loops of bowel, spreading peritonitis is apt to be produced by the attempt at drainage; it is not necessary, because in the vast majority of cases the mass will spontaneously disappear. Our study furnishes ample evidence to prove that with more than 90 per cent of these patients careful observation over a period of days will reveal a gradual improvement in the clinical picture, a gradual reduction in the temperature and the leucocyte count, a progressive diminution in the size of the inflammatory mass and, finally, after perhaps ten days to four or five weeks, its complete disappearance, as far as one can tell by physical examination. We advise these patients to return to the hospital after approximately three months, when they are feeling perfectly well. The appendix may then safely be removed, no matter how densely it may have been involved in adhesions. Only a few cases in this group (in our experience) will take the opposite course, with a progressive aggravation of the clinical picture and a progressive enlargement of the palpable mass to the stage at which it represents unquestionably a real 'abscess'. Under these circumstances it will have definitely tried to point somewhere, either anteriorly against the parietal peritoneum, where it can easily and safely be drained through what amounts to an extraperitoneal approach, or downward more deeply into the true pelvis, where it can be felt as a soft bulging mass against the anterior wall of the rectum and where it has a fair opportunity to break through spontaneously without the aid of surgical intervention. In our study, 228 patients have been classed in this group. Of these, twenty-five were operated on for drainage, but I am sure that for some of these the procedure was not necessary, and a longer period of observation would doubtless have shown this to be true. All of the others (203) were given the benefit of watchful conservatism, and of these 198 recovered, a mortality of only 2.5 per cent.

**GROUP 3.**—In contradistinction to those in groups 1 and 2 the cases included in group 3 represent acute perforations of the appendix into the open peritoneal



cavity; perforations against which there has at no time been established an adequate defence. Pathologically speaking, in many of them the condition is of the obstructive type, with a large faecal stone, and the perforation is grossly of considerable size. To use a crude simile, it is not unlike a sudden 'blowout' of a tire, in contrast to a slow leak. Often the streptococcus is the predominant organism, and often too the patient's resistance to infection is low. As a rule he looks very sick; there is a pinched, anxious expression; the tongue is dry; the pulse is fast, and the fever and leucocyte count are variable. The knees are held in flexion; the breathing is thoracic; the abdomen is distended; on palpation one finds the muscles everywhere tense, and there is more or less general tenderness, at times even in the left flank. The whole picture is suggestive of spreading peritonitis.

What shall we say as to the care of this patient? Has he a better chance to recover if he is not operated on and use is made of the so-called Ochsner method of treatment, with Fowler's position, adequate physiologic solution of sodium chloride and dextrose given by vein and under the skin, restriction of fluid by mouth, a Levine tube for relief of distension, and administration of mild sedatives, in the hope of diminishing peristalsis and perhaps of localizing the spreading infection? Without question, a number of surgeons hold this view (many of prominence among them), and it would take a bold critic to claim that such measures are not of great value. But we would ask these surgeons: Would they apply this conservative regimen to all patients in this group or to only a few? And if to only a few, to which ones? Would they apply it only in the late stages or in the early ones as well? Would they apply it only to patients with evidence of widespread involvement of the peritoneum or to those also in whom the infection is apparently limited? We have often heard it said that if the patient has been sick for less than forty-eight hours he should be operated on; if for more than forty-eight hours, operation will be withheld. Some place the limit of time at even less; others would arbitrarily fix it at fifty-six hours or even more. To these points of view we humbly and in all seriousness express our belief that no physician, however wise he may be, can hope to judge accurately the rapidity of pathologic changes; no physician, even from the most carefully obtained history (especially with children) can be certain as to the exact duration of the attacks of appendicitis (which is so often preceded or accompanied by other things which cloud the picture); no physician can always be sure of the exact time when the perforation has occurred, nor can he be certain, even by the most painstaking examination, of the extent of involvement of the peritoneum by the spreading infection. If these statements are true, why should one allow such unreliable criteria as these to influence one as to the decision for or against surgical intervention?

The answer is that one should not. We are of the firm opinion that those who advocate a conservative course with patients in this group are wrong, because it appears to us that the essence of the treatment should consist in removal of the ruptured appendix, which closes the leak through which a constant stream of infected material is being fed into the peritoneal cavity. Just as with an open perforation of a duodenal or a gastric ulcer, the essential thing is to close the opening as soon after it occurs as possible. With us there has been, therefore, an ever increasing tendency over a period of years to apply this policy of immediate operation to practically all patients in this group, no matter how long have elapsed since the onset of illness, and we are more and more convinced of the wisdom of this course. We do not, however, wish to give the impression that when we use the term 'immediate operation' we mean that the patient is sent from the admitting room to the operating table, for long since we have seen the value of adequate preparation, with restoration of the electrolyte and fluid balance, relief of distension as far as possible with a Levine tube and, finally, use of a measure which has lately been emphasized by Gatch and his associates

and has been used by us empirically for a long time, i.e., replacement of lost plasma protein (both before and after operation) by means of blood transfusion.

As to the operative procedure for patients in this group, perhaps little need be said. The McBurney incision is almost always employed. Cultures are always made of the free pus when the peritoneum is opened. The Poole suction tip has practically replaced the use of sponges in the abdominal cavity. The perforated appendix is delivered with a Babcock forceps, which encircles its wall; the stump is always ligated with catgut and whenever possible is buried beneath a catgut purse string. As to the matter of drainage, there is still considerable difference of opinion among our own group as to its value. Some are bold enough to close these incisions without a drain. (We have had occasion several times to open these incisions later to allow free evacuation of foul-smelling pus, and in one instance, in which a diffuse anaerobic phlegmon of the entire right abdominal wall had developed subsequent to a tight closure, we were obliged to reflect enormous flaps of skin to expose the area involved to the open air.) A few prefer to close the peritoneum and drain only the incision itself. We believe, as do most other surgeons, that it is not mechanically possible completely to drain the infected peritoneal cavity by the introduction of one or more tubes, yet we continue to use drainage in every case of perforation, always employing drains of the soft cigarette type and always placing them as near the source of the infection as possible. Especially do we feel that they are of value when the perforation has occurred behind the caecum, because they may help to prevent an ascending infection in tissues not protected by peritoneum and thus minimize the likelihood of a subphrenic abscess.

With what success has this regimen been rewarded? In this period of a little over four years 306 patients have been classed in group 3. Of these, only twenty-five (8 per cent) were treated conservatively, with a mortality of 80 per cent, whereas 281 (90 per cent) were given the benefit of 'immediate' operation, with 242 recoveries (mortality, 12.8 per cent). It will also be noted that in the past two years all patients were operated on, no matter how much time had followed perforation.

#### CONCLUSIONS

1. Immediate appendectomy is indicated in all cases of acute appendicitis before perforation unless the attack is clearly subsiding.
2. When the clinical evidence shows that the appendix is ruptured and the infection is definitely localized (demonstrable by a palpable mass), a conservative course is indicated. Only a few patients will need surgical drainage.
3. In all cases in which spreading peritonitis is present without evidence of localization, it is a wise plan to remove the source of the infection as early as possible, institute proper surgical drainage and make every effort postoperatively to restore to the circulating blood whatever elements have been reduced as the result of the infection.

#### Significance of the Tonsils in the Development of the Child

By A. D. KAISER, M.D.

(Abstracted from the *Journal of the American Medical Association*, Vol. CXV, 5th October, 1940, p. 1151)

DURING the last thirty years many significant facts have been ascertained relative to the growth and to the development of the child. Particular attention has been given to the status of the tonsils and adenoids as one of the factors that may influence the child's physical progress. In this period an increasing number of children have been classified as possessing hypertrophied or diseased tonsils resulting in the surgical treatment of the tonsils in nearly 50 per cent of urban

children in the United States and England. This situation invites a survey of the tonsil problem and an evaluation of the tonsils as a factor in the child's development.

The tonsils have assumed an important rôle in the economy of the child during the last thirty years. The beneficial results following tonsillectomy in selected cases inspired this procedure on a large percentage of children often without a good reason.

Follow-up studies on tonsillectomized and non-tonsillectomized children were undertaken to show the trend of certain complaints over a ten-year period in the two groups and to note the effect of the tonsils on the physical development of the child.

It was shown that markedly hypertrophied tonsils and tonsils that are repeatedly inflamed giving rise to attacks of tonsillitis and cervical adenitis frequently do impair normal physical development. When such a condition exists after the age of 4 years it is advisable to have the tonsils removed, with the expectation that at least 50 per cent of the children so treated will be materially improved.

Such infections as the common cold, otitis media, sinusitis and laryngitis may unfavourably influence the child's normal development. It cannot be demonstrated that the tonsils are often a causative factor in these infections; consequently tonsillectomy does not offer a solution for their eradication save in exceptional cases.

It could not be shown that the incidence of such diseases as bronchitis, pneumonia and tuberculosis was reduced in tonsillectomized children. The tonsils are not often responsible for pulmonary infections.

Rheumatic disease and nephritis constitute serious handicaps to a child's normal development. Recent studies show that the tonsils play a less significant rôle in the causation and treatment of these diseases than was formerly supposed. However, a reduction in the number of throat infections following tonsillectomy has a beneficial effect in the rheumatic subject.

There has been a significant decline in the mortality and morbidity rate of children during the last three decades. There has also been an improvement in the physical development of children in America. The application of the new discoveries in the field of nutrition, immunology and sanitation has contributed much to this favourable situation. When proper consideration is given to these factors it is evident that the tonsils are not as great a menace to a child as has been frequently suggested.

There is substantial evidence that in about 20 per cent of the children the tonsils are either hypertrophied or diseased and therefore have an unfavourable influence on the physical development of the child. Such tonsils should be removed.

### Chemotherapy of Meningococcal Meningitis

By H. STANLEY BANKS, M.D., D.P.H.

(Abstracted from the *Lancet*, Vol. II, 28th October, 1939, p. 921)

Of a total of 147, the first 65 cases of acute meningococcal meningitis were treated with serum in intensive intravenous dosage and sulphanilamide in somewhat varying dosage. There were 8 deaths, a case-fatality rate of 12.3 per cent for treated cases, 13 complications and 3 known sequelæ (deafness). These figures are exclusive of 6 cases in which treatment could not be applied, and of these 4 were fatal. The gross mortality from the disease during the currency of this series was, therefore, represented by 12 deaths in 71 cases or 16.9 per cent.

Next 72 cases, comparable to a high degree, were treated by chemotherapy alone in high dosage, 31 with sulphanilamide, 36 with M. & B. 693, and 5 with a combination of both drugs. There was 1 death, giving a case-fatality rate of 1.4 per cent for treated cases, 6 complications and 2 known sequelæ (deafness). Four cases, untreated or inadequately treated, and all fatal, were excluded from this series. The gross mortality from the disease during the currency of this

series amounted, therefore, to 5 deaths in 76 cases, or 6.6 per cent.

Initial dosage of sulphanilamide sufficient to maintain a c.s.f. concentration of 5 mg. per cent for three days and a lesser concentration for a further period of five or six days is the minimum reliable standard. Low initial dosage is distinctly unsafe.

Intensive intravenous serum therapy does not compensate for low dosage of sulphanilamide. No evidence in favour of auxiliary treatment with serum was obtained.

Similar high dosage is recommended for M. & B. 693, although there is evidence that lower dosage of this drug will often be successful.

Persons of all ages were amenable to chemotherapy. Infancy is not now an age of unfavourable prognosis, but further experience is required for prognosis in the age group over forty.

Groups I and II meningococci are equally susceptible to chemotherapy.

The oral route can be used throughout in most cases. For vomiting or difficulty in swallowing, an occasional intramuscular injection of M. & B. 693 soluble (sodium solution) is convenient.

In certain cases a combination of M. & B. 693 and sulphanilamide is serviceable.

### Testosterone Propionate in Chronic Mastitis

By A. W. SPENCE, M.D., F.R.C.P.

(Abstracted from the *Lancet*, Vol. II, 14th October, 1939, p. 820)

THE cause of chronic mastitis is doubtful, but laboratory evidence suggests that the changes in the breasts may be due to the action of ovarian hormones, more especially oestrogens. Ovarian activity is inhibited by suitable doses of male hormone, and Desmarest and Captain were the first to report favourable results in chronic mastitis by intramuscular injections of testosterone acetate. In 16 of 17 patients it brought about relief of mammary pain and diminution or disappearance of adenomatous nodules. Turpault and Bender have recommended testosterone propionate for the treatment of mastodynia, and Loeser, using larger doses, observed the disappearance of nodules in 3 patients treated. In the present series of 24 patients with painful breasts and/or so-called chronic mastitis, 16 were treated with testosterone propionate with dramatic relief of pain in most cases; diminution of the nodules, although effected in some patients, was less striking.

Of 24 patients with painful breasts and chronic mastitis treated with intramuscular injections of sterile olive oil (as a control), pain was relieved in 13, whether they had lumps in the breast or not. No further treatment was given to 8 of these 13 who had no lumps.

The remaining 16 patients were treated with testosterone propionate injected intramuscularly in doses of 25 mg., 50 mg., and 100 mg., usually twice a week for several months. In 14 patients pain was relieved.

In 12 patients treated there were lumps in the breast; in 3 the lumps disappeared, but in 2 of these spontaneous disappearance could not be excluded, and in 1 2,925 mg. in five months was required, resulting in hypertrophy of the clitoris and extreme atrophy of the endometrium. In 5 patients there was some reduction in the size of the nodules. In 2 patients who were not improved fresh nodules appeared in the breast during treatment.

Menstruation was suppressed in 7 patients receiving the larger doses.

Increased growth of hair developed in 5 of the younger patients, in 4 with comparatively small doses, but this was not observed in older patients receiving much larger doses. It is emphasized that because of this complication and the undesirability of prolonged atrophy of the endometrium, testosterone propionate should be used with caution in women.



## Prevention and Treatment of Decubitus in Fractures

By T. A. FOX, M.D.

and

G. L. APFELBACH, M.D.

(Abstracted from the *Journal of the American Medical Association*, Vol. CXV, 26th October, 1940, p. 1438)

DECUBITUS is a major problem of a fracture service having an annual turnover of 1,400 patients. In spite of prophylaxis, its incidence is such that it frequently overshadows the original surgical condition requiring hospitalization. Bedsores often prevent open reduction.

The foreign and American literature offer little truly investigative work regarding aetiology or prophylaxis. We here report a newly developed technique in the prophylaxis and treatment of decubitus.

A series of 232 cases were followed over a period of three months. The average age was 51 years. There were seventeen patients with fractured hips, from 60 to 95 years old, ten who were diabetic, six with fractured pelvis, and one who had a compression fracture with paraplegia. Of the original fifty-five patients six had simple decubitus while twenty had deeply necrotic bedsores.

Pressure is recognized as the chief cause of decubitus. It occurs usually over the sacrum, buttocks and heels, and less commonly over the malleoli, greater trochanters, scapulas and elbows. Pressure also occurs at the upper and lower edges of casts and at the ring of a Thomas splint. Trauma may be a contributing factor, caused by friction from bedclothes, rucks in sheets or dressings, gritty dusting powder or plaster, bedpans or other features of nursing care. Moisture, as in perspiration, urine or faeces, macerates the skin and allows the entrance of infection. Senility, with its associated atrophy of the skin, is also a predisposing factor. Pressure areas due to lack of muscular development are more common in women. The skin of the Negro is less susceptible to decubitus. Hypovitaminosis is likewise a predisposing factor. Anorexia, poor dentures and associated dietary deficiency are common in the aged. The malnutrition and hypovitaminosis of alcoholic patients are well recognized. Hypoproteinemia with oedematous skin, dehydration and chronic shock are frequently associated factors. Incontinence of urine or faeces is commonly encountered, especially in the aged, and cord injuries lead to trophic disturbances with resulting infection. An increased incidence of bedsores in disease of the pancreas is recorded.

Love classifies bedsores as follows: stage 1 (threatened), with generalized redness of the skin which blanches readily and immediately reappears when the pressure is released; stage 2 (inevitable), with increased redness which assumes a purple hue, pressure causing no blanching. Early a vesiculation occurs over the purple-red area. These small vesicles and blebs soon break, close scrutiny being required to discover them. The resulting weeping surface is ideal for infection. The stage passes into stage 3 (ulceration), with sepsis and toxic absorption.

We observed that these pressure areas resemble the blebs and vesicles of a second degree burn. Latimer also records this fact. In burns the skin is injured by thermal trauma with local oedema and bleb formation. Decubitus pressure, from body-weight or cast, causes dilatation of subcutaneous vessels and increased irritability of vasomotor endings in the skin; this results in the initial erythema with ready blanching on pressure. With continued pressure there is vasomotor paralysis and stasis. This accounts for the purple colour and failure of the tissues to blanch on pressure, which in turn produces local oedema and bleb formation.

Decubitus causes little pain, at least after the first day, probably owing to a pressure palsy of sensory fibres and to oedema of the skin. With proper treatment only the first two stages should occur. Lesions in our cases never reached the stage of ulceration.

In the treatment of decubitus, prophylaxis is of the utmost importance. The breaking down of the skin must be avoided. With this in mind a 'calamine varnish',\* a mechanical and pharmaceutical aid, was developed. All pressure points are washed with tincture of green soap, alcohol and ether. The calamine varnish is applied with a brush and allowed to dry. Ordinary photographer's rubber cement is then spread over the same area and allowed to dry. These form a thick elastic coat over the points of pressure. The soothing astringent antiseptic coat, with its protecting layer of rubber, forms a pressure-proof, bacteria-proof, moisture-proof prophylaxis for decubitus. This is a routine procedure in the fracture ward. It may be repeated as often as necessary. It prevents the breakdown of tissue.

Careful observation of the patient's skin is essential. Should vesicles or macerations appear they are immediately debrided and sprayed with a 10 per cent solution of tannic acid and 1 per cent salicylic acid. When dry a 10 per cent solution of silver nitrate is painted over the area. This forms a black supple thin tough crust which gives a 'new skin' surface and requires no further treatment. With infection and necrosis, fresh diluted solution of sodium hypochlorite is used freely. We do not cauterize exuberant granulations. This only adds a necrotic crust to a clean surface. A razor trims the overgrowth of tissue to the level of the skin surface. Epithelium can then bridge the gap.

Since recovery in the twenty original cases, there have been no deep ulcerations. When clean they are treated as described. Skin grafts may be necessary. There was only one instance in our series. Latimer describes the use of tannic acid in the treatment of necrotic decubitus and this method has been used by Love, Spiesman, Cope and many others. Nayrac and Morel described the use of 5 per cent silver nitrate to stiffen the skin in early lesions. Proper application of prophylaxis, as outlined, should in most instances prevent decubitus with fractures and chronic illness. With the simple treatment here outlined the existing bed sore readily heals. The prognosis of decubitus is improved. Patients requiring surgical therapy need not forego its benefits because of bedsores.

## Closed Plaster Treatment of Infected Wounds

By G. R. GIRDLESTONE, F.R.C.S.

(Abstracted from the *Lancet*, Vol. II, 13th July, 1940, p. 31)

THE 'closed plaster method' has been assembled part by part; and it is well to consider separately each process with its purpose, for there is no need to reject enclosure of the wound and immobilization of the soft tissues because the full ritual is unnecessary or in part contra-indicated.

1. The débridement; the general rule is to excise, as far as practicable, infected tissues, and tissues devitalized by bruising or by the impairment of circulation. This rule governs the excision of skin, connective tissue and muscle; surgical sense will guide the operator when he reaches more delicate ground.

2. To lay open rather than suture when suturing would involve tension and devitalization of the skin or deep parts.

3. A varying degree of 'saucerization', which allows natural retraction of the muscles to the position of equilibrium, and involves a laying open for the free drainage of all pockets or areas of heavily infected or

\* Tragacanth 2 per cent, benzoic acid 1 per cent in Ringer's solution to make 100 per cent. Add to this prepared calamine N. F. 7.5 per cent and bentonite 2.5 per cent. The calamine and tragacanth are well known emollients. The bentonite is a mildly antiseptic astringent aluminum silicate clay and the benzoic acid a preservative.

damaged tissue which cannot properly be excised. For serious destructive wounds the requirements vary from the saucer to the cup; but there are many wounds, earlier and less destructive, in which no such formal exposure of the deep tissues is indicated. At times nothing more may be needed than a single layer of broad wick laid between the edges of the wound after débridement.

4. The plaster splintage with its dual purpose: (a) the restoration of function, by keeping the bones, joints and muscles at rest in the chosen position; (b) defence against the spread of infection, by keeping the reactionary cellular infiltration undisturbed in the tissues and lymph-channels round the wound.

5. A particular technique of enclosure of the wound in that part of the plaster which covers the exposed tissues. It should apply an even gentle pressure similar to that normally exercised by the fasciæ and the skin.

6. The elimination of frequent dressings, which mean either pain or repeated anaesthesia for the patient and are both time-consuming and expensive.

Trueta lays stress on (a) the good vascularity of the tissues left after débridement; (b) the avoidance of any trauma or antiseptic application to these tissues; (c) the avoidance of tight packing of the wound, or other firm pressure on exposed tissues; and (d) the application of gentle uniform pressure over a thin and evenly applied gauze dressing. He approves of a single layer of vaselined fine-mesh bandage under the gauze to prevent granulations growing into the loose meshwork of the gauze.

The success of the closed plaster method depends on its correct application to the individual case, on the judgment and skill displayed in the earlier processes and on the perfection of the plaster work. It is desirable to keep the patient under supervision for two or three days, for only thus can one be sure that the plaster is comfortable and that no untoward signs are developing. Hasty evacuation may make this impossible, but if the treatment has been efficiently carried out the patient should travel in safety and comfort.

#### SOME FALLACIES

It has been said that after a certain period, say, two or three days, the closed-plaster method is not applicable to a dirty wound because excision of the wound is no longer practicable. This is a great mistake. In my opinion no method of treating such a case can compare with closed plaster after saucerization, which may include laying open all heavily infected areas. A wound that will benefit from saucerization and enclosure does not always need excision; indeed, excision is generally contra-indicated in the presence of established sepsis. On the other hand a late wound which has been unsuccessfully treated by excision and suture may need the whole ritual, as in the case here described, where there was necrosis of the sutured skin, widespread and deep-seated infection and devitalized deep tissues.

Again, it has been said that for wounds near a joint this method is unsatisfactory on account of resultant stiffness of the joint. It is true that when early excision and suture without tension can be undertaken the method need not be applied. But where the wound has involved the widespread laceration and devitalization of tissues, or where, due to lapse of time, there is spreading infection, the closed plaster method when compared with an attempt to achieve closure by imperfect excision or by strong tension suture gives not only relative safety of life and limb but also a better prospect of movement. In all extensive wounds near joints the posture of the limb with reference to the situation of the wound is of great importance. It is usually possible to foresee which movements are likely to be restricted by cicatrization; and to put up the limb in a position which will favour the difficult movement.

The method has been decried because a number of wounded men treated by closed plaster in France and Belgium have reached hospital in this country with wounds doing badly or miserable from extensive pressure-sores. Probably the surgeons were imperfectly

familiar with the method, certainly their plaster-work failed to stand the severe test of early evacuation and a very long journey.

#### PLASTER-OF-PARIS IN WAR-TIME

He who would apply plaster in war must be skilful in its use, or he will be a danger to his patients and bring undue discredit on the method; he had far better continue to treat wounds on more familiar lines. It is unfortunate that the most helpful plasters are the most exigent. It is difficult enough in favourable circumstances to put on, under anaesthesia, the plaster required for an extensive bomb wound involving a shattered humeral shaft. Such a plaster includes the whole upper limb with the trunk and pelvis; for the 'plaster of splintage' must obtain a complete and comfortable hold upon both proximal and distal parts if the 'enclosure plaster' is to exert an even and unvarying pressure all over the wound and its neighbourhood. Wherever considerable weight is to be carried on the plaster, as in a shoulder or a spica plaster, protection of the areas of pressure by padding is desirable, preferably by soft white felt.

If this closed plaster method is to give results as good as those for bomb wounds in Barcelona or gunshot wounds in Madrid those who use it must fully understand each process. Unfortunately plaster technique receives little attention in our medical schools. Few students or house-officers have the opportunities of learning how to apply extensive plasters which will accurately and comfortably control the whole trunk and one limb. If a wound is to do well it must first be given appropriate operative treatment: after this the progress of the wound and the comfort of the patient depend on the fit and inner smoothness of the plaster.

The surgeons of the last war found themselves abandoning antiseptics in favour of débridement, packing and less frequent dressings; later Winnett Orr enclosed the wound; to Trueta we owe the finer developments of the technique and its adaptation to varying degrees of destruction and infection in the light of his unique experience and scientific study.

#### Pharmacological and Therapeutic Action of "Calci-Aurum" (a gold preparation of Ancient Hindu Medicine)

#### A Monograph from the University Hospital, Hamburg

By D. DWARAKANATH, L.M.

and

HERBERT SCHOLZ, Dr. Phil.

THERE is an old Indian gold preparation which was known in Ayurveda and was prepared in India. After quantitative analysis, solubility experiments were carried out whereby it was proved that the preparation possesses an oligodynamic action and can be partially dissolved by the juices of the body.

In animal experiments it was shown that by oral administration, gold is absorbed from this drug and is excreted from the circulation through the kidneys.

The preparation does not show any toxicity.

In normal animals (guinea-pigs) the gold is stored in the cells of the reticulo-endothelial system. This fact was also demonstrated by photomicrography.

In animal experiments, an increased appetite and an improvement in general health were observed after the preparation was given for only a short time. After feeding with the gold compound for four weeks there was a significant increase in weight in all the experimental animals.

In animals injected with diphtheria, an increased resistance against inflammatory processes (infectious) was demonstrated. The animals treated with the gold

preparation resisted the toxin poisoning longer and with effective resistance.

A new method for the identification of the minutest quantity of gold in organic and inorganic substances was worked out and used.

The gold is also absorbed by human beings and it is stored in the reticulo-endothelial cells.

Increased appetite, betterment of general health, diminution of temperature and a good increase of

weight as a result of these manifestations have also been observed in tuberculous patients.

The administration of this preparation is also recommended in those cases in which a solgona treatment is contra-indicated.

The last three effects were observed in patients whose condition had so far advanced that a cure was thought out of the question. In better cases, clinical and x-ray evidences proved the improvement and stoppage of the processes.

## Reviews

**SURGERY OF THE MODERN WARFARE.**—Edited by Hamilton Bailey, F.R.C.S. Compiled by 65 contributions. Part I. Section I:—Wounds: General considerations. Section II:—Wounds: Special considerations. 1940. E. and S. Livingstone, Edinburgh. Pp. iv plus 160. Illustrated. Price, 12s. 6d. Postage, 6d.

Our knowledge on traumatic surgery at the beginning of the last war was very different from our knowledge on this subject at the end of that war; still further changes had occurred by the beginning of the present war; to-day we know much more than we did in September 1939; and one may reasonably assume that by the end of this war considerable further changes will have taken place. Therefore, the best time to write a book on war surgery would, from a theoretical point of view, be at the end of this war; the book would, however, by then, we all hope, be almost useless. After a little over a year of war, during which period theories born in peace time (and in other people's wars) have been tested and procedures modified, a point has been reached at which there is a considerable degree of stability in war-surgery practice; this seems to be the psychological moment for the publication of an authoritative book on war surgery.

The decision to publish this book in parts was also a very wise one, as it obviates the inevitable delay associated with the publication of a large volume. When the last part has been published the publishers have promised that a suitable binding will be issued.

Should one entertain any doubts as to the authoritative nature of the publication, it is only necessary to read the list of contributors to dispel these, for the list contains the names of many of Great Britain's leading surgeons, all of whom are unfortunately in the front line in this war on civilians.

If the whole publication can be judged on part I, it will be a remarkably practical one. After two introductory chapters on instruments of destruction and the classification of war wounds, the editor puts first things and gives us a chapter on shock, appropriately followed by one on transfusion. The latter constitutes the best account of the technique of this invaluable life-saving procedure that the reviewer has had the pleasure of reading. There are only 27 pages devoted to the subject, but every step of the procedure, from the blood grouping onwards, is given in minute detail, and usually illustrated. Still maintaining the natural sequence, the next chapter is on anaesthesia. Chapters on war burns, the localization of foreign bodies, the local treatment of recent wounds and of infected wounds follow, and the section concludes with a useful chapter on chemotherapy. Section II, which is also included in part I, contains eight chapters, still on general subjects such as gas gangrene, tetanus, suturing, and skin grafting.

The book is profusely illustrated; many of the illustrations are in colour. It is a matter of wonderment to us in this country that medical books, in fact books of all kinds, still seem to be produced in Great Britain, and that, up to date, there is not the slightest sign of deterioration in quality. This book is a particularly good example. No surgeon can afford to be without this book, for, even if he is not in the

front line to-day and does not propose to volunteer, to-morrow the front line may move to his door.

(Parts II and III have been received and will be reviewed in a subsequent number.)

**EDINBURGH POST-GRADUATE LECTURES IN MEDICINE.** Volume I. 1938-1939. Published for the Honyman Gillespie Trust. By Oliver and Boyd, Edinburgh. Pp. xvi plus 513. Illustrated. Price, 10s. 6d.

THERE are in this volume thirty-three lectures on a diversity of subjects, all of which have a direct or an indirect bearing on medical practice; the lecturers include specialists in almost all branches of medical science, for the most part associated with the Edinburgh medical school.

The lectures are nearly all of an eminently practical nature and the doctor who could not get away from his practice to attend the post-graduate course, or courses, where the lectures were delivered, will gain some compensation by having this opportunity of reading them in a concise form, and being able to refer back to them when he has forgotten a point.

Medical readers will appreciate this volume whether they were educated in Edinburgh or not, but for the latter there will be a particular appeal.

Professor Davidson's article on macrocytic anæmias will be read with very great interest in India, and his classification will be very helpful. All the types that he includes are represented here, but we believe that there are others. Professor Goodall, in his lecture on pernicious anæmia, emphasizes a very important point which has its application far beyond the subject of his lecture; this is his appeal against polytherapy in anæmia:—

'I would plead for the avoidance of speculative therapeutics by the use of preparations of liver with iron. Any need for the combined use of liver and iron is rare, and the indications for such treatment afford difficulties even for an experienced hematologist. The harm done by liver and iron combinations is that treatment by the necessary ingredient is generally half-hearted, while the other ingredient is useless. The half-hearted treatment often leads to a condition of semi-invalidism and the appearance of a blood picture exceedingly difficult to diagnose. If the patient recovers, no one knows what he has recovered from, and maintenance treatment is apt to be either inadequate, or to be given unnecessarily.'

This applies with even greater force to the treatment of fever in India.

In his lectures on occupational therapy, we see the lecturer, Colonel J. Cunningham, in an entirely new rôle. A decade or more ago, he was a frequent contributor to the medical literature in India, on bacteriology and closely allied subjects, but Colonel McKendrick, a contemporary of the former, lectures on a subject that has always been his own, the dynamics of crowd infection.

The reviewer notes with very great pleasure the words 'Volume one' on the title page; this pleasure will, he feels confident, be shared by the reader who follows his advice and purchases a copy of this book.

**THE NEW INTERNATIONAL CLINICS.**—Edited by George Morris Piersol, M.D. Volume I. New Series Three. 1940. J. B. Lippincott Company, Philadelphia and London. Pp. iv plus 319. Illustrated. Price, 60s. for 4 volumes published quarterly.

THIS well-known series of practical and important articles on subjects of special interest to the general practitioner still maintains its high standard.

The present volume contains a number of interesting articles of the usual quality. It is difficult to single out one article for special mention, but Drs. Held and Goldbloom on 'Jaundice' particularly appealed to the reviewer who is looking forward to the second half of this article that is promised in the next volume.

Another article, on the treatment of prothrombin deficiency with vitamin K by Dr. J. E. Rhoads clears up some confusion that existed in the reviewer's mind regarding the various substances that are labelled 'vitamin K'. This substance seems to have provided one of the few examples of successful gilding of the lily, for the chemist has produced a synthetic substance that is more active than the natural vitamin.

That very difficult problem of the relation of gastritis to anaemia is tackled by Dr. T. G. Miller; he accepts the general opinion that gastritis plays no part in the aetiology of pernicious anaemia, but rather grudgingly, as he finds the two conditions so consistently associated.

'The Review of Recent Progress' with which the volume concludes is on vitamins and it provides, in about eighty pages, a very comprehensive summary of our present knowledge on the important vitamins, A to E and K.

The articles are well worth the permanent form given to them in the well-bound and handy volume of this series.

**MODERN MEDICAL THERAPY IN GENERAL PRACTICE.**—Edited by David Preswick Barr, A.B., M.D., LL.D. Volume I. General Therapy Methods used in Therapy, General Diseases. 1940. The Williams and Wilkins Company, Baltimore. Volume I—Pp. xvi plus 1200 plus xxx. Illustrated. Obtainable from Messrs. Baillière, Tindall and Cox, London. Price for three volumes—£9-12-6

THIS is not an ordinary dictionary of treatment. In the first place it consists of three large volumes. The first volume deals mainly with the subject in a general way. The book is not divided into numbered chapters or sections, but the subject is dealt with under a number of headings, e.g., psychotherapy, the use of drugs, vaccines and sera, organotherapy, dietotherapy, physiotherapy, etc. This covers over seven hundred pages of the volume; in the remaining four hundred odd, the treatment in specific groups of diseases is given, e.g., allergy, deficiency diseases, diseases due to chemical and physical agents, and intoxications.

There are about a hundred contributors; the large majority of these hold teaching appointments in American universities or medical schools. Each section, and in many cases the sub-sections, are well annotated, and in some instances where rare conditions are being dealt with the writer is content to refer the reader to some other publication; there is much to be said for this procedure, for it saves overloading the text with details which will very rarely be required; individuals may take exception to this, but it will benefit the majority. A good example is bacteriophage; in this 3700-paged work it receives less than a page, but there are eight references. The writer incidentally gives it no place in therapy.

The section of dietotherapy is unfortunately named and to the British reader the word conjures up the semi-quack diet whose initiator makes a fortune by selling his popular book in which he expounds his totally unscientific hypothesis in pseudo-scientific language. This section is not of this nature at all, but is a very valuable and complete discussion on dietary requirements in health, with tables of the constituents of various foodstuffs. There is an entirely separate

section on deficiency diseases and yet another on diseases of metabolism; it is in both these groups of diseases that dietotherapy, as we visualize it, plays a supreme part.

Sprue is classed as a deficiency disease. The condition described is not the disease that we see in India though it has many of its features. The treatment advocated is the American version of Fairley's high-protein diet and would be suitable for a European or American subject with this disease. The section on diseases of metabolism is a large one of about 130 pages, and is virtually a small textbook on diabetes; the treatment of obesity is, however, included in this section.

We have only one criticism to offer, namely that the main section heading appears at the top of the right-hand page and one therefore receives no assistance in finding any particular sub-section.

This work will be found extremely useful in this country; it presents the American point of view, which in the reviewer's opinion is quite often the right one.

The other two volumes have been received and will be reviewed in a subsequent issue.

**TREATMENT IN GENERAL PRACTICE: SURGERY (CONTINUED). ARTICLES REPUBLISHED FROM THE 'BRITISH MEDICAL JOURNAL'.** Volume IV. 1940. H. K. Lewis and Company, Limited, London. Pp. x plus 562, with 143 illustrations. Price, 16s.

THIS is the fourth volume of this series; we are glad that the war has not prevented the publication in book form of these very useful articles on treatment in general practice. The third volume was on anaesthesia and surgery, and this volume continues the subject of surgery. The volume contains articles mainly on what would be classed as minor surgery, but a few are definitely major, e.g., fractures and dislocations of the spine, and there is rather surprisingly an article on the treatment of ringworm of the foot; this is a useful article, but does not perhaps sufficiently emphasize the dangers of over-treatment of this troublesome condition.

The authors are representative of the best British writers on surgical subjects, the treatment advocated is up to date but usually orthodox, and is in most cases clearly presented. The volume forms a very valuable addition to the series.

**DISEASES OF INFANCY AND CHILDHOOD.**—By Wilfred Sheldon, M.D. (Lond.), F.R.C.P. (Lond.). Third Edition. 1940. J. and A. Churchill Limited, London. Pp. xii plus 756, with 130 text-figures and 14 plates. Price, 24s.

THIS book has already acquired a reputation as a very sound and practical book on the diseases of children, in its first two editions. The first edition only appeared in 1936, so that it is comparatively a new recruit to the field of pediatrics; its author however is not, and the book has the advantage of his long practical experience in the treatment of children, as well as his obvious ability to present his subject completely and concisely in a manner suitable for the student or practitioner. For the latter, it forms a very valuable book of reference.

The new matter in this edition, naturally, is mainly concerned with the use of the sulphanilamides, but information on other important subjects has been added, e.g., the Vollmer test for tuberculosis; this test does not entail any injection or scratching, and the reaction is produced by contact of tuberculin with the skin only. It will be popular where children (or their guardians) are nervous of the needle, but it is not quite as delicate a test as the well-established Mantoux test.

There are some very valuable appendices, which have been added in this edition. One gives the contents of the various vitamin preparations, proprietary and otherwise. Another is a sulphanilamide dosage table for infants and children.

The book is punctuated profusely with prescriptions; these will prove of great value to practically minded readers, even if they are a source of irritation to the fastidious ones, for the writer has shown a fine disregard for uniformity and Latin case. He has worked an

incredible number of changes by varying his abbreviations and his use of capitals, by alternating Latin and English forms, and quite frequently by mixing them but perhaps the printer is to blame for the period after *ad*. Anyone who has written a book will realize that there is plenty of excuse for lack of uniformity in a first edition, but in a third it indicates either carelessness or calculated disregard for niceties. The book would gain immeasurably in the eyes of the fastidious reader—and let me assure the author and publishers that there are many such—if in the next edition the prescriptions could be written in their full Latin form with the correct cases observed; the work could be relegated to a secretary. From a practical point of view the book would lose nothing.

However, the prescriptions as they stand will have a special appeal to the practitioner in this country, and in fact, though there is little reference to tropical conditions, it is a book that we can strongly recommend to readers of this journal.

**HYPERTENSION AND NEPHRITIS.**—By Arthur M. Fishberg, M.D. Fourth Edition. 1939. Baillière, Tindall and Cox, London. Pp. 779. Illustrated with 40 engravings and a coloured plate. Price, 37s. 6d.

THIS famous book, which has entered its fourth edition, needs no introduction. Since the publication of its third edition much work has been done in the fields of nephritis and hypertension, and it is gratifying to note that all the recent advances have been incorporated. An attempt has been made to differentiate glomerular and tubular elements in renal failure. Goldblatt's experimental production of hypertension and the surgical treatment of essential hypertension have been discussed in considerable detail. Hypertensive encephalopathy has been thoroughly rewritten. Prerenal azotæmia has been admirably discussed in a separate chapter. Among other new additions, may be mentioned the nephrotic syndrome in diabetes, hæmoglobinauric nephrosis, experimental production of glomerulo-nephritis, and the treatment of the nephrotic syndrome by concentrated blood serum.

Every chapter is written in a masterly style and every nook and corner of these difficult subjects discussed in considerable detail. The book not only gives one the idea of what we know but also of what we do not know. The chapter on renal and hypertensive disease in pregnancy is worth special mention. It has been rightly concluded that toxæmia of pregnancy is nothing but latent hypertension becoming manifest as the result of pregnancy, and eclampsia is toxæmia of pregnancy plus hypertensive encephalopathy. Fishberg rightly points out that the present-day practice of rigid protein restriction and administration of plenty of fluid to flush out the kidneys is the ideal condition for leading to oedema formation and hypertensive encephalopathy; in other words the chances of eclampsia are enhanced. Obstetricians in this country would do well to read this chapter carefully.

However well a book may be written there is always some room for criticism. Fishberg uses the term 'impairment of renal function', and it seems paradoxical that in chronic nephrosis there is no impairment of renal function even in the presence of massive albuminuria. 'Impairment of concentrating ability' would in the reviewer's opinion be a less confusing term, as this gives an idea of one phase of renal function, i.e., concentration.

It is unfortunate that the omnibus term 'arteriosclerosis' is still being used. Arteriosclerosis includes at least atherosclerosis, diffuse hyperplastic sclerosis and Monckeberg's medial sclerosis. Of these atheroma is a degenerative process independent of high blood pressure but possibly accelerated by high blood pressure; diffuse hyperplastic sclerosis, on the other hand, is the direct result of high blood pressure. Atheroma is usually found in cases of hypertension not because of any causal relationship, but because both the diseases occur at the same age period. Much confusion has arisen and it is desirable that the term arteriosclerosis be omitted and replaced by appropriate terms as far as practicable.

Finally, we find no reason for using the term 'angina' for tonsillitis. There are several printing mistakes which we hope will be corrected in the next print.

These comments are made not with the idea of discrediting the book in any way, but simply as constructive criticism to enhance the value of the book.

It goes without saying that this book is the best of its kind in the English language and should be in the hands of every serious student of medicine. The binding, printing and get-up of the book are beyond criticism.

T. R.

**MODERN DRUGS IN GENERAL PRACTICE.**—By Ethel Browning, M.D., Ch.B. 1940. Edward Arnold and Company, London. Pp. vii plus 236. Price, 10s. 6d.

DR. ETHEL BROWNING is a versatile writer; the last book of hers we encountered was a very large tome on the vitamins. She shows courage in the choice of her subjects because a book of any size on the vitamins must necessarily be out of date before it is completed. The same remark applies, with perhaps less force, to a book on modern drugs; this however is a short book and the authoress has managed to keep pretty well up to date with her subject. An exception is the omission of any details regarding sulphathiazole, a drug that has now been in use, in America at any rate, for some time, and is proving to be one of the most valuable of the sulphanilamide (*sensu lato*) group of drugs.

The conception of this book is a good one and does not need the apology with which the preface opens; war or no war, patients still require treatment. The execution is also masterly (if this is the right adverb in the circumstances). The compilation of the data from various sources has been carried out very carefully and presented concisely, and it makes an ideal book of references for the practitioner.

The subject-matter is arranged more or less on a pharmacological basis. Proprietary, as well as non-proprietary, drugs are included, but, as the writer has observed (twice) in the preface, of the former only those whose reputations have been established by reports in medical journals have been included.

The book constitutes a valuable addition to the practitioner's library.

**A TEXTBOOK OF OPHTHALMOLOGY.**—By Sir W. Stewart Duke-Elder, M.A., D.Sc. (St. And.), Ph.D. (Lond.), M.D., Ch.B., F.R.C.S. Volume III. 'Diseases of the Inner Eye'. 1940. Henry Kimpton, London. Pp. xxviii plus from 2097 to 3470, with 1,140 illustrations, including 164 in colour. Price, 70s.

THIS is the third volume of this stupendous textbook which comprises 1379 pages with 1,140 illustrations including 164 in colour.

It maintains the same high standard as the previous volumes, and deals with the uveal tract, the retina, the optic nerve, the lens, the vitreous body, glaucoma and hypotony, and finally intra-ocular parasites.

The whole volume makes most delightful reading, but of special interest to ophthalmologists working in India are the chapters on the anomalies of intra-ocular pressure and diseases of the lens, as he comes across so much of this in the ordinary routine of his work and so much blindness is due to glaucoma and cataract.

Duke-Elder discusses admirably in great detail the important subject of the surgical treatment of glaucoma and in his summing up of the operative treatment of chronic glaucoma states that in the recent past that Elliot's operation was particularly favoured in England and America within recent years, but in India the Elliot operation is tending to fall out of favour on account of latent infection, hypotony and secondary cataract, and the operation of sclerecto-iridectomy by various modifications is now more commonly done.

We have nothing but admiration and praise for this work and again congratulate the author on the



magnitude of his task. Needless to say, we strongly advise and recommend every medical man in India interested in eye work to obtain this book as quickly as possible. As a reference book within the English language it makes most others fade into insignificance.

E. O'G. K.

**A GUIDE TO OPHTHALMIC OPERATIONS.**—By J. Bruce Hamilton, M.B., Ch.M. (Syd.), D.O. (Oxon.), D.O.M.S. (Lond.), F.R.A.C.S. 1940. H. K. Lewis and Company, Limited, London. Pp. xv plus 201. Price, 10s. 6d.

THIS book of some 200 pages comprises the lists of instruments, drugs and requirements for most of the operations in eye work, together with a foreword by Sir James William Barrett, the doyen of Australian ophthalmology. The pre-operative and post-operative treatment are also discussed.

The author has intended the book primarily for the ophthalmic surgeon and his staff working in private hospitals, and nursing homes, but it will also be found most useful for the staffs of big ophthalmic hospitals, as there is probably no branch of medicine which demands such attention to detail, and such care and gentleness as ophthalmology, both for doctor and nurse if one is to obtain the best results.

The book is excellent and fulfils a distinct want in ophthalmic literature, the author is to be congratulated on his industry and attention to detail.

For India we would like to see the Webster mucous graft operation for cicatricial entropion and the fascia lata graft for ptosis included.

We would like to bring this simple little book to the notice of all hospitals in India in which eye work is done. It will be found invaluable as a guide and help, and we strongly recommend it for all the practical information it contains.

E. O'G. K.

**THE ANATOMY OF THE EYE AND ORBIT: INCLUDING THE CENTRAL CONNECTIONS, DEVELOPMENT AND COMPARATIVE ANATOMY OF THE VISUAL APPARATUS.**—By Eugene Wolff. Second Edition. 1940. H. K. Lewis and Company, Limited, London. Pp. x plus 374, with 242 illustrations. Price, 31s. 6d.

THIS is the second edition of this book which is written to present the structure, development and comparative anatomy of the normal eye in conjunction with some of their clinical applications. It consists of 367 pages with 242 illustrations and is divided into ten chapters in which the author describes the bony orbit and the accessory sinuses of the nose, the eyeball, the appendages of the eye, the normal appearances as seen with the slit lamp and corneal microscope, the extrinsic muscles of the eye, the nerves, the visual pathway, the vessels, the development of the eye, and finally the comparative anatomy.

In the second edition some sixty illustrations have been added, the blood supply of the visual pathway has been rewritten, there is a note on the differential staining of the rods and cones, and something new about the structure of the vessels of the iris.

The book is excellent and there is little to criticize. It is profusely illustrated with excellent drawings and is written in a simple clear style. To every ophthalmic surgeon and student of ophthalmology, we strongly recommend it, as without a sound knowledge of anatomy the art of ophthalmology is impossible and the book supplies a much needed want.

E. O'G. K.

**CLINICAL ROENTGENOLOGY OF THE ALIMENTARY TRACT.**—By Jacob Buckstein, M.B. 1940. W. B. Saunders Company, Philadelphia and London. Pp. xiv plus 652, with 525 illustrations. Price, 50s.

THE interpretation of x-ray observations and of the skiagrams of the intestinal viscera is essentially the work of the physician, as it must be done in the light

of the whole clinical picture and of the biochemical and other examinations that have been carried out. He may accept the report of the radiologist, but he should not let it sway his opinion unduly. On the other hand, he will often find that the radiologist has seen points which he has missed; therefore after making up his own mind he should read the radiologist's report very carefully, and be prepared to revise his own opinion.

The physician will find this book invaluable in assisting him to interpret the roentgenological findings in the intestinal tract. He will read for example that '*the diagnosis of duodenitis on the basis of roentgen evidence must be made with considerable circumspection*' (author's italics), and that the beaded appearance of the appendix which he has had pointed out to him by radiologists as evidence of disease, is, in fact, evidence of a normally functioning organ, and much else that will teach him to rely on his own judgment and his clinical findings, and not to be stampeded by an ill-advised radiologist's report.

The sections in this book are, respectively, on the oesophagus, the stomach, the duodenum, the small intestine, the large intestine, herniation of the diaphragm, the gall-bladder and bile ducts, and the spleen, liver and pancreas. There are over five hundred well-selected skiagrams; the normal is given a very fair share of these, and, in those showing some abnormality, relevant clinical operation and/or autopsy notes are given.

In conclusion, it is a book that every physician and surgeon will want to study, and that every practising radiologist should be compelled to read.

**PRIMITIVE TUBERCULOSIS.**—By S. Lyle Cummins, C.B., C.M.G., LL.D., M.D. 1939. John Bale Medical Publications Limited, London. Pp. 213. Illustrated. Price, 10s. 6d.

THE author, who has lately been David Davies Professor of Tuberculosis, Welsh National Medical School, and whose work on the epidemiology of tuberculosis is well known, has assembled in this extremely interesting book, not only his first-hand knowledge about tuberculosis in Europe, Egypt, Africa and Burma, but also extensive references on the subject from other countries.

The title of the book refers to tuberculosis among 'primitive' communities or communities 'which continue to live in their old tribal tradition, to employ primitive, instead of modern methods, in their pastoral, agricultural or military occupations, to retain their native customs as to property, marriage, education, food and barter, law, order and discipline, habitations and "taboos" costume and language, as opposed to the adoption, from foreigners, of the weapons, machinery, coinage, religion, social outlook and occupations of modern civilization'. This, in fact, refers to isolated and non-industrialized communities. It is well known that, with increasing industrialization and wealth, the standard of living improves and with improved communications the differences between isolated and urban communities fade. Well-isolated communities like the Central Africans and the aboriginal tribes in India may come under the connotation of 'primitive' communities, but it will not be apt to say the same thing with regard to a large part of China and India where tuberculosis has been prevalent in crowded communities for many centuries, although the introduction of the machine age from the West has intensified the complexity of the picture.

The book will be of very great interest to all tuberculosis workers, particularly those dealing with tropical countries and isolated communities. The literature on the subject has been critically reviewed and the author has drawn balanced conclusions therefrom. The complicated but fascinating subject of hypersensitivity and immuno-allergy in people of isolated communities has been well expressed in the following paragraph:—

'Being quite unacquainted with the tubercle bacillus or only "acquainted" during a few generations, the "primitive", when brought into contact with that germ, tends to become extremely hypersensitive, to break down easily into an acute form of the disease,

and to suffer from a high mortality, especially when brought, further, into the industries or the separations which follow upon his association with the white man. On the other hand, he will, when left in his village, either die quickly or become a "chronic" case, the latter being at first uncommon but becoming much more frequent as the tribe becomes more immune. If civilization continues to obtrude itself on the reluctant "primitive", it will lead to much slaughter of the least immune but will, in the end, reach a state when the immunity will become partially established, as now amongst the white men.

The author thinks that 'for some time to come the "primitives" and their less primitive descendants will react, as they do at present, to tuberculin and tuberculosis, as to a new stimulus; to tuberculin by the exhibition of hypersensitivity and to tuberculosis by severe reaction'. It will, therefore, need several generations of 'exposure' to infection and the slaughter of the susceptibles before a level of relative immunity, comparable to that of highly industrialized western European communities, can be attained. A clear conception of these factors will undoubtedly fortify the epidemiologist, the pathologist, the clinician and the sanitarian with the necessary background for the interpretation of his findings.

The author has ably discussed the various explanations which are offered to explain differences in the response of the tissues to infection and relative immunity—a subject not yet very well understood. It has been shown in several countries that a pronounced sensitiveness to tuberculo-toxin and a low immune status are often combined together in principally agricultural populations and that they may account for the nature of the pathological changes met with there. Social factors, immuno-biological factors and, the author thinks, racial factors play a part in modifying these reactions. All workers may not agree with the author's view that the immunity gained in the ancestors is transmitted to the offspring, making subsequent stocks resistant.

Tuberculosis in India has been given a separate chapter in which the author has endorsed the opinions of several workers, notably Lankester, Ukil, Benjamin and Frimodt-Møller. His recent visit to Burma has confirmed the previous findings of the Indian workers. In dealing with tuberculosis in Burma, the author believes that there is some other factor more important than either food or housing, the tuberculosis mortality not corresponding to the worst houses and that this factor is the low resistance to tuberculosis through the many generations of Burmans which have experienced a relative absence of the germ.

The subject of prophylaxis of tuberculosis by means of B.C.G. vaccine has received attention in a separate chapter devoted to it. It had already been pointed out by Indian workers, notably Ukil, that there was a good field for trial of this vaccine to populations which migrated from rural and isolated communities into towns and industrial areas.

The select bibliography at the end of the book will prove useful to workers interested in the subject.

The author, who has been interested in epidemiological problems ever since the early years of the present century, is to be congratulated on the production of a book which is of absorbing interest, is written in pleasant language and is replete with facts and personal observations. Every medical practitioner ought to profit by a perusal of such a book.

A. C. U.

**TUBERCULOSIS OF THE UPPER RESPIRATORY TRACTS.**—By F. C. Ormerod, M.D. (Manch.), F.R.C.S. (Eng.). 1939. John Bale Medical Publications Limited, London. Pp. viii plus 215. Illustrated. Price, 21s.

GENERAL physicians, tuberculosis workers and laryngologists owe a debt of gratitude to Dr. Ormerod for bringing out such a comprehensive account of some of the difficult complications of pulmonary tuberculosis and for giving a well-balanced view of diagnostic and

therapeutic methods, based on his 16 years' contact with the throat and ear department of the Brompton Hospital, London.

The book is divided into four sections—tuberculosis of the (a) larynx, (b) pharynx and its associated structures, (c) nose, accessory sinuses and nasopharynx, and (d) ear. One hundred and thirty-six out of 215 pages have rightly been devoted to the important subject of tuberculosis of the larynx, including a chapter on lupus of the larynx. Besides a short historical note, each section deals with the aetiology, pathology, symptomatology, diagnosis, prognosis, treatment, and end-results of the different conditions. Each of these aspects of disease has been ably dealt with and, where methods of diagnosis or treatment are concerned, their relative value has been emphasized by the recording of the author's own experience. The illustrations are nicely executed and well reproduced.

A very useful reference has been made to the value of tomography in the detection of laryngeal lesions. We agree with his views that although 'radiography is in its usual form, of little or no help in the investigation of tuberculosis of the larynx', the introduction of tomography has provided a means for demonstrating lesions particularly in the hidden territory below the vocal cords and the extent to which a lesion has extended downwards into the subglottic regions.

The author has put together much valuable information and experience in this handy volume. The select bibliography at the end of each chapter adds to the value of the work. The paper, printing, and get-up do credit to the publishers.

A. C. U.

**ARTIFICIAL PNEUMOTHORAX: ITS PRACTICAL APPLICATION IN THE TREATMENT OF PULMONARY TUBERCULOSIS. CONTRIBUTIONS BY SARANAC LAKE PHYSICIANS TO THE STUDIES OF THE TRUDEAU FOUNDATION.**—Edited by E. N. Packard, M.D., J. N. Hayes, M.D., and S. F. Blanchet, M.D. 1940. Henry Kimpton, London. Pp. 300. Illustrated with 85 engravings. Price, 21s.

THE volume represents a contribution by 17 Saranac Lake physicians to the studies of the Trudeau Foundation and deals with artificial pneumothorax (AP) and its practical application in the treatment of pulmonary tuberculosis; it is edited by an editorial committee consisting of Drs. Packard, Hayes and Blanchet, and contains a foreword by Dr. E. R. Baldwin. There is a melancholy touch with its publication inasmuch as Dr. Blanchet, who was a member of the editorial board and Dr. Lawason Brown, who first conceived the idea of such a publication, both died before the book appeared in print.

In spite of the somewhat disappointing late results of treatment of pulmonary tuberculosis by AP, it is acknowledged that it constitutes, along with rest and time, one of the best weapons to combat the disease. While the beginner in collapse therapy should be well acquainted with the indications and contra-indications for it, including the complications during its induction, the experienced specialist should know what had been the results of continued observation of a varied group of patients in the hands of eminent workers at a well-known centre like Saranac Lake, where ample clinical, laboratory and x-ray facilities were available. Physicians who have to treat tuberculosis will find sound guidance for their work in the present volume.

In addition to the chapters on artificial pneumothorax, the consideration of collateral subjects like the heart in artificial pneumothorax, oleothorax and the applications of other methods of collapse therapy has made the book more useful to general, as well as tuberculosis, physicians. The final chapter is rightly devoted to consideration of the results of treatment by AP. Each chapter is replete with useful information and hints. It is not possible to deal with them in this short review. Artificial pneumothorax is so extensively used to-day in the treatment of pulmonary tuberculosis that the publication of a practical guide like the present



volume has removed a long-felt want. The value of the subject-matter has been enhanced by the inclusion of a useful bibliography at the end of each chapter.

The book has been well produced and does credit to the publishers.

A. C. U.

**PHARMACOLOGY.**—By J. H. Gaddum, S.D., M.R.C.S., L.R.C.P. 1940. The Oxford University Press, London and New York. Pp. xv plus 407. Illustrated. Price, 17s. 6d. Obtainable from Oxford University Press, Bombay and Calcutta

THIS is certainly a very unusual book and seems to call for an unusual review.

We are, we hope, sufficiently far away to avoid direct reprisal for any personal remarks about the author. We visualize him as a comparatively young man of North country origin with a scientific bent, who only qualified in medicine because his scientific leanings were towards medical science and not because he had any intention of practising. He has made a special study of certain aspects of pharmacology and he rather despises the medical man, especially *in embryo*, who has to learn such a little about such a lot of subjects, so he throws him little bits of pharmacological information which he can take or leave as he likes, but that is all he is going to get! He is we should imagine a good teacher with a clear and direct manner of expression, but with a distinct weakness for trite remarks.

So much for the writer.

The first chapter is on diet and deals with water and the inorganic salts, calcium and hyper- and hypocalcæmia, and fats. The next chapter is on vitamins; it contains a great deal of concise, up-to-date, and useful information on the subject, and the same may be said of the next two chapters, on hormones, which are divided, rather usually, into those of known and those of unknown structure. Chapters 5, 6, and 7 are on the central nervous system, stimulants, and depressants including narcotics.

Chapter 8 is on body temperature. The next eight chapters deal with systems, or parts of systems, sensory nerves to respiration. The rest of the chapter headings do not seem to follow any particular line of thought and are on proteins, heavy metals and metaloids, drugs that destroy life, chemotherapy, metazoa and bacteria, and there is a final chapter on general pharmacology.

Our only criticism is that the author has allowed his conciseness to carry him too far; it is a mistake on the right side from the student's point of view, but it leaves the reader the task of trying to follow the author's line of thought in order to work out his cryptic remarks. When he says, of phenolphthalein that 'it may do harm when distributed in chocolates amongst irresponsible people', one's mind has to jump suddenly from the pharmacological laboratory to the chemist's shop and the advertisements in the daily paper.

He writes, under the heading 'malaria', 'over a quarter of the people of the world suffer from malaria and they consume 600 tons of quinine annually, which is not enough'. This is excellent, because it is so true. But when he writes of tetrachlorethylene, 'Many thousands of men and women have been treated with it; there have been no fatalities among the patients, but unfortunately no one knows how many fatalities there have been amongst the worms' his triteness is merely silly, because the statement is untrue.

However, taking it all round, it is a book that the student will find very helpful and the information in it is certainly enough for any ordinary examination purposes; the specialist will want more complete information, but there are plenty of books where he can get it, whereas the student will find few books that will meet his needs as well as this one. We also recommend it strongly to teachers of pharmacology in India.

**PERSONALITY AND MENTAL ILLNESS: AN ESSAY IN PSYCHIATRIC DIAGNOSIS.**—By John Bowlby. 1940. Kegan Paul, Trench, Trubner and Company Limited, London. Pp. xii plus 280. Price, 10s. 6d.

THIS is another of quite a number of books published in the last few years which proclaim the emergence of a radical change of outlook in psychological medicine. As such, if for no other reason, this book will be welcomed by all those to whom this change of outlook appeals. The essence of this change is that the psychopathic individual differs quantitatively not qualitatively from the so-called normal person. In other words, all mental symptoms, whether major or minor, always involve the total personality. No intelligent psychiatrist to-day would take exception to Dr. Bowlby's contention that the divorce of mental symptoms from the personality as a whole has been responsible hitherto for the use of an outstanding symptom as a diagnostic label. Hence psychoneuroses and psychoses should come now to be regarded as individual variations of personality. The author, while impressed by the work of Kretschmer and Bleuler, both of whom showed that the personalities shown by schizophrenics differ in many respects from those shown by manic-depressives, goes one step further by attempting to show how it may be possible not only to predict the type of psychosis or psychoneurosis from which any one person might fall in, but to make a fairly accurate estimate of his chance of recovery. The book is provided with a good bibliography and a satisfactory index.

**THE DIABETIC LIFE: ITS CONTROL BY DIET AND INSULIN. A CONCISE PRACTICAL MANUAL FOR PRACTITIONERS AND PATIENTS.**—By R. D. Lawrence, M.A., M.D., F.R.C.P. (Lond.). Twelfth Edition. 1941. J. and A. Churchill, Limited, London. Pp. ix plus 246, with 18 illustrations. Price, 9s.

WE have great pleasure in reviewing the 12th edition of Dr. Lawrence's *Diabetic Life*. That the book is extremely popular is evident from the fact that within a period of 17 years it has undergone 12 editions.

No fundamental changes has been made in the present edition, except that a few alterations of practical importance have been made in some sections and that a loose page has been added on the war-time precautions for diabetics.

There is a small point, however, referred to by us previously and partially modified by the author, since that requires, in our opinion, still further modification. We are disinclined to agree with the statement of the author that 'The Bengalees and other Southern Indian races who live mainly on rice are very prone to mild diabetes'. Our observations on Indian diets generally and Bengalee diet particularly clearly indicates that rice-eating does not, by itself, act as a contributory factor of diabetes in India.

It is significant that in spite of war-time rationing, the author has thrown out important suggestions for the modification of diet according to the prevailing conditions, the more important among these are the use of vitaminized margarine to replace butter, which is almost of equal value to diabetics. By giving up the sugar ration, diabetics can now receive an extra meat ration and two extra fat rations (12 oz.) per week, a doctor's certificate being required by the food office.

Amongst the war-time precautions for diabetics, particularly during air raids, the author suggests that severe cases of diabetes, who cannot do without big doses of insulin without getting acidosis, should always carry insulin and a syringe with them. They should also carry a small supply of concentrated carbohydrate food, such as sugar, chocolate, or biscuits in their pockets; so that if the regular timing of meals is upset enough carbohydrate can be eaten to balance the insulin.

We earnestly hope that the book will continue to be as useful and as popular as its predecessors.

J. P. B.

**DELTAIC FORMATION WITH SPECIAL REFERENCE TO THE HYDROGRAPHIC PROCESSES OF THE GANGES AND THE BRAHMAPUTRA.**—By C. Strickland, M.A., M.D. 1940. Longmans, Green and Company, Limited (17, Chittaranjan Avenue), Calcutta. Pp. xiii plus 157. Illustrated

THE day is long past when the physician was expected to have a deep knowledge of all scientific subjects and was prepared to write books or papers on such diverse subjects as ornithology and geology. Is this because, as a profession, we are being made of poorer stuff? Or is it that our estimate of the word *deep* has undergone a profound change, and that a hundred years ago scientific knowledge was so shallow that anyone who scratched the surface could claim special knowledge, whereas to-day the physician has so much to learn about his own subject that he cannot hope to go beyond this? We sincerely trust that our second explanation is the true one, but no one who allows himself to ponder over these matters can fail to feel some slight misgiving at the present trend towards extreme specialization in scientific knowledge. It is therefore with very great pleasure that we have received a book by a doctor, recently retired from a professorship in a medical institution, on a subject that is essentially a geological one.

There is, of course, a link between Professor Strickland's specialty, medical entomology, and the subject of his book, deltaic formation; this is provided mainly by that arthropod-enemy no. 1, the mosquito, and it was during his expeditions into this enemy's domains that the author made most of the observations on which this book is based.

It would be wrong to say that hitherto the subject has been a neglected one, for long before child psychology was taken up seriously by the medical profession, geologists in India were doing far more than merely scratching their heads over their problem children, the wayward rivers of the Indo-Gangetic plain, who will never make up their minds which way they want to go and who, when you build them nice bridges to pass under, insist on going round them, but little has been written on delta formation, certainly very little that the ordinary educated man can understand. No one who has any interest in this subject, direct or indirect, can fail to appreciate this little book. Each step is

clearly explained, the whole story is unravelled before the readers' eyes in Dr. Strickland's pleasant style, and where any obscurity might exist this is clarified by the aid of simple diagrams. The book also contains a number of interesting and relevant photographs.

As a mild criticism we might add that the author has a style which though pleasing, as a whole, exhibits a tendency towards obscure constructions and archaic forms. Also, the geologist may complain about some of his terminology, but to the average reader this will be the contrary to a defect.

Above we deplored the extreme tendency to specialization in science, but there are signs that the tide is turning and schools of hygiene include lectures on geology in their programmes; a book on such a subject as the physical condition and the formation of deltas, especially relating to a country like Bengal, where the subject is discussed daily by politicians, sanitarians, economists, and the man in the street, in relation to the problems of the province, is not only the natural outcome of this trend of interest, but should be welcomed by people of all classes.

**AIDS TO ANATOMY (POCKET ANATOMY).**—By Professor E. P. Stibbe, F.R.C.S. Tenth Edition. 1940. Baillière, Tindall and Cox, London. Pp. vii plus 369, with 50 illustrations. Price, 5s.

It is rather difficult to assess the value of 'Pocket Anatomy' in these days when the achievement of success in learning anatomy no longer lies in the mastery of the details. The teaching now is directed—and more profitably so—towards its bearings on clinical studies. But, nevertheless, a synopsis of such relevant anatomical facts appears to have its field as an aid to the students in their attempts to control the multitude of facts studied from voluminous texts. To render real service, such books must cease to be merely a narrative of bare facts without including clinical relationships.

Professor Stibbe has endeavoured, by way of improvement upon the previous editions, to incorporate in its limited scope, matters having clinical significance. The present volume is, therefore, likely to be much more serviceable than those of the past.

There are one or two mistakes, e.g., in the 'note' on page 74 where 'Hallucis' should be 'Pollicis'.

S. C. S.

## Abstracts from Reports

**ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH. ANNUAL REPORT BY THE CURATOR OF THE LABORATORY FOR THE YEAR 1939**

**Statistics of anti-rabies treatment.**—A ninth analytical review by the superintendent of the results of anti-rabies treatment at the Pasteur Institutes of the world, as deduced from statistics submitted to the League of Nations, is in the press. The figures cover a two-yearly period, and relate to the years 1936 and 1937, the number of persons treated being 304,525. Of these 797 (0.26 per cent) contracted the disease in spite of treatment. In attempting to assess the relative efficiencies of the various methods of treatment employed, recourse has been had to the whole statistics dealt with in the nine successive reviews. The number of persons treated during this period was 1,062,707, of whom 3,540 (or 0.33 per cent) contracted rabies. There seems little to choose between the dried cord, dilution, killed phenol (carbolyzed), live phenol, Fermi, heated, and killed ether methods of treatment as regards their immunizing properties, whilst a mixed method (dilutions, plus in severe cases the live ether vaccine of Alivisatos) is apparently associated with a reduction of mortality which does not exceed 45 per cent, and may be as low as 3 per cent. On the other hand, the risk

of accident as the result of treatment in the case of treatment by killed vaccines is less than 1 in 7,000, whereas in the case of those treated by living vaccines it is greater than 1 in 3,500.

Statistics of treatment in the Union of Soviet Socialist Republics have for various reasons been separately dealt with. The number of persons treated during the period 1929-1934 is 380,090, of whom 612 (0.16 per cent) died of rabies. The conclusions regarding the efficacies of the different methods of treatment employed are in general accordance with those found in the main report.

**Trichomonas and thrush vaginitis.**—This work showed that the commonest cause of leucorrhoea in pregnancy is an infection with *Trichomonas vaginalis*, 37.5 per cent. Next in importance is an infection with the thrush fungus *Oidium albicans*, 24.5 per cent. In a few cases both parasites were present. Both these parasites have been studied in detail and the various micro-organisms associated with them in the vagina have been noted. The latter possibly play some part in influencing the course of confinement and the puerperium. It is certain that the thrush fungus in the vaginal secretion of pregnant women may communicate infection to their infants and thus give rise, in certain circumstances, to serious mortality among them. The true cause of the mortality is often overlooked.

and attributed to diarrhoea, vomiting and broncho-pneumonia.

In studying the conditions which conduce to the development of vaginal infections, attention has been directed to the hydrogen-ion concentration of the vaginal contents. It has been shown by Oberst and Plass that the hydrogen-ion concentration of the vaginal contents is not materially altered by limited dilution with neutral water. These workers had made determinations on eighteen specimens of vaginal discharge, comparing the undiluted pH readings with diluted specimens obtained by washing out the vagina with 15 c.cm. of neutral distilled water. They found that the wash fluid usually, but not invariably, showed a pH somewhat lower than that of the undiluted discharge, and they concluded that for general purposes the pH of the wash fluid may be more accurate than the reading obtained by small undiluted portions of the discharge.

Using a special pipette the following characteristics of the vaginal contents of normal pregnant women were established. (1) Epithelial cells are almost always more numerous than pus cells. (2) At least half, but generally a larger number, of the epithelial cells are well filled with glycogen. (3) The hydrogen-ion concentration of the vaginal contents is always lower than 5, more often about 4. (4) Döderlein's bacillus is present in large numbers to the almost complete exclusion of other organisms. These findings suggest the existence of a complicated protective mechanism. In contrast, the following findings were established as characteristic of leucorrhœa in pregnant women. (1) The vaginal contents showed that pus cells were present in larger numbers than epithelial cells. (2) The epithelial cells were relatively deficient in glycogen when compared with the normal and this was particularly noteworthy in *T. vaginalis* infections. (3) The hydrogen ion concentration was generally higher, around 5, in thrush infections and around 6 in trichomoniasis. (4) Döderlein's bacilli were more or less completely replaced by other organisms, less markedly in thrush infections, more definitely in trichomoniasis where a great variety of organisms are found.

**Chemistry of vaginal discharge.**—These fundamental facts in regard to vaginal infection are being investigated further. It has been recognized for some time that the acid reaction of the vaginal contents is related to the presence of lactic acid. Little quantitative work, however, seems to have been done on the lactic acid content of the fluid, and it is not known to what extent differences of lactic acid concentration account for the differences in pH observed.

From a knowledge of the lactic acid content of the washings, and the percentage of discharge they contain, it is easy to deduce the lactic acid content of the discharge. The pH value of the discharge may be taken as that of the washings. A considerable number of fluids have been examined from various conditions, including several normals. Although there is a tendency for fluids of high pH values to contain unusually small amounts of lactic acid, the relationship is not a strict one, and factors other than the lactic acid content are apparently of importance in determining the pH. It is hoped that the investigation will shed light on the nature of these factors, and their relation to the clinical condition.

Additional *in vitro* experiments on the action of various oils upon bacteria suspended in them were carried out. Improvements were made in the methods of suspending the micro-organisms in the oil and of estimating quantitatively the amount of peroxides in an oil. With these improved methods it was found that liquid paraffin had no influence upon the vitality of bacteria for 35 days (which was the limit of the experiment), olive oil killed bacteria in from 7 to 10 days, cod-liver oil in 17 to 22 hours, irradiated cod-liver oil in 1 to 3 hours, and linseed oil in 1 to 1½ hours. It was further found that the amount of peroxides in these oils was proportional to the bactericidal power (*i.e.*, inversely proportional to the length

of time during which bacteria survived being suspended in the oil).

## ANNUAL REPORT OF THE CENTRAL CO-OPERATIVE ANTI-MALARIA SOCIETY LIMITED FOR THE TWENTIETH YEAR HELD AT THE ALBERT HALL, CALCUTTA, ON 23RD MARCH, 1940

This report does not lend itself to abstraction because the main part of it, which is the report of the secretary, is a review of anti-malarial work in various parts of the world, and is written for laymen interested in the subject.

A list at the beginning, however, gives an indication of the remarkable growth of the movement begun in 1917 when two societies were formed. The actual date of the commencement of the Co-operative Society was 1919 and since then, when four societies were in being, it has steadily grown until now there are 2,362 societies in Bengal of which 1,019 are registered.

The annual general meeting was held on 23rd March of this year when many prominent persons attended, several of whom made interesting speeches. Sir Malcolm Watson was elected president for the second time, having first occupied this position 11 years ago. His address is full of interest to those interested in malaria control for it gives an outline of what has been achieved in malaria control in the many parts of the world where the Ross Institute, of which he is the Director, carries on this work.

## ANNUAL PUBLIC HEALTH REPORT OF THE DELHI PROVINCE FOR THE YEAR 1939

### CLIMATOLOGY

THE total rainfall for the year was 17.66 inches, which is 10 inches below normal, and exceeds that of the previous year by 4.99 inches. Throughout the year it rained only on 33 days. The highest monthly mean temperature was recorded in May with 94.9° and during this month the highest temperature level of 114° was reached on one day. The lowest figure recorded was 37° in January only. The widest diurnal range was recorded on 16th April when the maximum temperature was 98° and the lowest 63°—a range of 35°. The highest mean humidity was 70 per cent recorded in July and the annual mean 51 per cent, both figures showing difference from those of the previous year, namely 86 per cent and 56 per cent, respectively.

### VITAL STATISTICS

**Population.**—The estimated mid-year population was 732,005.

**Births and deaths.**—This year showed (a) an appreciable reduction in the number of births with a corresponding fall in the birth rate; (b) a rise in the infant mortality rate; (c) a fall in the maternal mortality rate; and (d) a slight reduction in the death rate which on the whole is steady.

### CHIEF CAUSES OF MORBIDITY AND MORTALITY

**Smallpox** attacked no less than 1,098 persons of different ages during the year under review, and accounted for no less than 606 deaths.

During the year primary vaccinations and revaccinations have risen respectively from 32,857 and 131,784 to 35,862 and 206,867. The improvement in vaccination during the last three years has been very remarkable. This has been obtained by:—

- (a) vaccination throughout the year instead of in the winter season only;
- (b) making vaccination the regular duty of all those who are qualified to perform the operation, particularly the maternity and child welfare staff and school medical officers; and
- (c) the revaccination of all children on admission to school (*i.e.*, at the age of 5).

### Cholera

At the beginning of November, a sharp outbreak of cholera occurred which was localized to the Sadar Bazar area of the city. And no apparent cause could be discovered for the outbreak. The majority of cases belonged to the Muslim community, at that time observing the fast of Ramzan, and it was thought possible that the evening feasts at the break of the fast were a contributory factor to the spread of the disease.

The health authority in Delhi Municipality took very energetic steps to deal with the outbreak immediately it was recognized and by the first week of December the disease finally died out.

The total number of cases which occurred in the province was 158 with 96 fatalities as compared with 318 and 182 respectively in 1938. Inoculations against cholera were carried out, representing a proportion of 5.33 per cent of the population.

### Malaria

There was a further drop in the incidence of 'fever' during the year. How many of these cases can be attributed to malarial infection it is impossible to state, and there can be little doubt that a substantial proportion was due to influenza. However the bulk number of cases of fever has definitely been reduced, and this may be due as much to the failure of the monsoon as to the anti-malaria measures taken. The total amount of quinine and cinchona consumed during the year was 180 lb. and 64 lb., respectively. Assuming that every case of 'fever' reported, had quinine in one or other form, each case had an average\* of 28 grains. This is a good average.

### Plague

The province has again been free from plague.

The cost of rat destruction activities was Rs. 25,335 in the urban area and Rs. 6,579 in the rural area. The rise in the former from Rs. 17,208 in the previous year is largely due to the purchase of a new supply of rat-traps.

### Eye diseases

There is a further increase in the number of trachoma cases treated but the ratio of trachoma cases to the incidence of eye disease generally has fallen from 44.32 per cent to 36.21 per cent.

### Osteomalacia

The recorded number of cases attending for treatment at the Lady Hardinge Hospital fell from 208 to 194. This variation has no significance.

### Cerebro-spinal fever

As in previous years, this disease occurred sporadically. In all, there were 32 cases with a mortality of 69 per cent.

### Tuberculosis

The mortality figures were much the same as they were in the preceding year. The figures which are now becoming available from the Queen's Road clinic and from the Rama Krishna clinic, show a distinct rise in the number of cases attending these centres. There have been many important developments in the sphere of tuberculosis during this year.

## HEALTH ORGANIZATION

### Provincial

The doctor in charge of the travelling dispensary normally tours by going out to various centres in the rural area and camping there for three or four days at a time. It will probably be found convenient in future to combine the functions of the superintendent, health operations and the doctor in charge as this arrangement will get over the difficulties at present experienced in maintaining a high standard of supervision.

### Rural

The main features during the year have been as follows:—

- (a) the progress made in the improvement of rural communications by the building of new roads;
- (b) the progress made in the consolidation of holdings;
- (c) the growing appreciation by the rural population of the services provided by the health organization;
- (d) the continued improvement of water supplies;
- (e) the enlistment of village assistance in the fight against malaria;
- (f) the growing improvement of rural housing;
- (g) the marked improvement of environmental hygiene in the villages;
- (h) the greater measure of co-operation between beneficent departments in the province through the agency of the Central Officers' Board;
- (i) the growing realization by the villages of the value of vegetable cultivation which is evident from the larger areas cultivated this year in comparison with the previous one.

A pamphlet of instructions in vegetable growing in Urdu has been prepared and has had a wide circulation.

- (j) the complete solution of the fly breeding problem at Okhla Sewage Farm.

No less than 67½ miles of new roads have been completed or partially completed at a total cost of over 10 lacs. The influence which these roads exert on health activities, apart from increasing the financial prosperity of the people, is incalculable. The beneficial effect of the new roads has been particularly marked in the Najafgarh health unit area which was rightly given preference in the programme.

The roads are designed to open up the rural area as to an extent which has not been attempted in other parts of India.

The construction of the roads has in itself conferred immediate benefits on the villagers which no health authority could afford to ignore in that, during a year of unusually severe economic distress due to failure of the rains, it has provided the villagers with a much needed means of earning money.

Another most important feature, of particular interest to this department, has been the scientific care exercised during the construction of the roads to prevent the concomitant nuisance from borrow-pits hitherto inevitably associated with road building. For this happy result the province is indebted to the personal interest and whole-hearted co-operation of the Superintending Engineer, Delhi province (Mr. Dean), who has been good enough to explain the method adopted as follows. 'The earth for the embankment was "borrowed" from land temporarily acquired outside the permanent width of land needed for the road. The maximum depth of the borrow-pits was fixed at 1 ft. As soon as the bank was completed to the full height and section required, the land, which had been temporarily taken over, was handed back to the cultivators for ploughing which largely obliterated the depressions caused by the excavation and levelled up the land.'

Of equal importance from the public health point of view had been the achievements of the co-operative consolidation of holdings societies. Up to date 22,325 acres represented by 33,711 blocks with an average area of 0.66 acre per block have been consolidated into 6,865 blocks with an average area of 3.325 acres. What this means to the public health department is the increase in the productive capacity of the land and, therefore, in the prosperity of the individual; the provision of *shamlat* (or common land) on which such vital necessities to the health of the villages such as refuse disposal pits, latrines and playing grounds can be sited; and the conversion of 412 acres of *barani* land into *shahi* by the sinking or transfer of wells which made it possible for vegetables to be cultivated.

An innovation of some importance in the practical education of villagers in their responsibilities as custodians of their own health has been the enrolment

in each village of 'malaria guards' charged with the important duty of guarding their village from the ravages of the mosquito. Their work, under the supervision of the health staff, consists in the levelling and filling of ground around their villages and in making it as difficult as possible for the vector to breed within an area which can harm them. The 'guards' have been presented with badges which they display with great pride, not matched in every case by their keenness to work, but there is every reason to hope that the movement will gather momentum and will prove in time to be a really effective instrument in the fight against malaria in the rural area.

An instance of the astonishing ease with which a village may fall from grace merely through 'pique' is provided by the fact that the winning village in last year's 'best village' competition has temporarily lost all interest in its betterment merely because the villagers felt they had been thwarted in the manner in which they wished to spend the prize money. There is every hope that this matter will be satisfactorily adjusted but the incident leads one to suspect that in this village at least, appreciation of village improvements has been rather superficial and not completely disinterested.

### Urban

**Housing.**—An advance of the most outstanding importance has been the acceptance by the Government of the principle that assistance should be given to a population dispossessed by slum clearance to enable them to obtain not only alternative accommodation, but accommodation of a better standard than that from which they have been rejected.

The main difficulty hitherto experienced in India in effective slum clearance has been due largely to the fact that the legislation devised for this purpose has not been as stringent as it is, for instance, in Britain and elsewhere. We in Delhi have to be much more 'gentlemanly', we have to pay for the slum houses, and to compensate the owner for depriving him of his means of exploiting human misfortune.

Having got as far as to eject a person from a locality or building declared to be unfit for human habitation, no machinery has existed in India for his being rehoused. If he could afford to build himself another house, facilities were provided for him to do so. Otherwise he just went elsewhere to live in the same squalor in which he had always lived and to create a slum similar to the one which had been cleared. Both in Cawnpore and in Calcutta where Improvement Trusts exist it was found impossible to deal with this problem for the simple reason that very substantial free grants were involved and these were not forthcoming. In England the cost of rehousing the poor has been accepted as a duty by the public and the state, and grants towards rehousing are made both by the central government and the local municipality concerned. Acceptance by the Government of India of this principle is, therefore, an advance of incalculable importance and one which may have the most far-reaching influence on the progress of house improvements and slum clearance in this country.

Under Indian conditions the minimum rent for a house fit for human habitation was assessed at Rs. 5 p.m., and the lowest income which could bear to pay such rent at Rs. 30 p.m. A family with an income less than this has been accepted by the Trust as one which cannot afford to pay for a house fit for human habitation and therefore needs assistance in rehousing.

This standard has been applied to an area in the city selected for slum clearance (Hathi Khana and Ara Keshan) where it has been found that 137 families come within the below Rs. 30 p.m. category.

The next important decision taken has been that of fixing a minimum standard of floor space for each person. Having regard to local circumstances generally this has been determined at 36 sq. ft. per person, no distinction being made for separation of sexes, and a room capacity of not more than three adults (counting two children as one adult) for a single-roomed house, not more than five adults for a two-roomed

house, and three rooms for a family consisting of more than 5 adults. Standard plans for one-roomed, two-roomed and three-roomed houses have been prepared on the basis of a plot of 100 sq. yards. The houses have been so designed as to make it easily possible for a one-roomed house to be converted by addition of rooms, into a two-roomed or a three-roomed house.

The cost will be roughly Rs. 450 for a one-roomed house, Rs. 600 for a two-roomed house and Rs. 750 for a three-roomed house. Now the average rent capacity of the families to be dispossessed is estimated at Rs. 2-13 p.m. while a return of Rs. 3-9 per mensem represents the minimum rent on a no profit basis. This figure includes maintenance at 1 per cent ground rent and repayment of capital plus  $\frac{1}{4}$  per cent margin for cost of collection. This, plus the equated instalments of the cost on a 20-year basis, works out to Rs. 5-3-6 per month.

The experiment proposed in Delhi is to make it possible for the poor class families concerned to own their houses on the hire-purchase system. This, besides being a desirable feature in itself as it gives each individual a stake in the land, is calculated to overcome the reluctance experienced in other cities in India for dispossessed families to move into houses built for them. Any family which can pay a rent of Rs. 3-8 p.m. will be admitted to the benefits of ownership through hire-purchase and the difference between what can be afforded and the minimum rent (plus equated instalments) is made up by grants from the proceeds of a special tax imposed by Government, namely, an entertainment tax. •

### NAJAFGARH HEALTH UNIT

The main points to be noted on the progress of the unit throughout the year are the following:—

- (i) the growing interest and appreciation displayed by the people in the activities of the health unit;
- (ii) the move of the headquarters office from the house in Najafgarh town to another, granted free of cost by Pandit Raghbir Singh of Najafgarh, who has also provided the medical officer of health and lady superintendent with a residential house free of rent and taxes;
- (iii) the appointment of Dr. (Mrs.) Bhatnagar as lady superintendent, maternity and child welfare in place of Miss Jessie Smith, retired;
- (iv) the growing importance of the health unit as a demonstration unit for students and as a controlled area suitable for research;
- (v) the improvements in communications, in vital statistics, in sanitation, in protection against smallpox, in maternity and child welfare and in the care of the school child.

Beside Pandit Raghbir Singh's gift, Pandit Ram Krishan of Paprawat has offered to build a centre to take the place of the existing hired house at Najafgarh. Unfortunately it has been impossible so far to make use of this generous offer owing to the lack of a suitable site, but the offer is still open. These gifts, though not by themselves proof, undoubtedly reflect the general appreciation by the public of the services provided by the health unit. The only section which may still be described as sullen and unmoved is Dandasa, but even here there have been encouraging signs lately of growing interest.

No minor part of the function of the health unit is the facility it affords for the training of students, medical or lay, and the fullest advantage has been taken of this facility throughout the year. Parties of students from the Lady Reading Health School and the Lady Irwin College each attended a specially arranged course lasting over a week during which they had the fullest opportunity of studying at first hand life of the villagers, the duties and functions of the skilled workers appointed to assist them, the organization of the health unit and the value or co-ordinated social services. A day tour was also arranged for the senior students from the Lady Hardinge Medical College. The Medical Officer of Health also fulfils the very important function of teaching the pupil teachers at



the normal training school, Najafgarh, all that is practical and important in hygiene and sanitation as applied to Indian village conditions, to schools and their environment, and to school children.

Fifteen villages in the health unit area were provided with radio sets and these pick up the rural programme broadcast from Delhi for an hour every evening. The villagers display the greatest interest in the broadcast and there can be no doubt of the value of this means of education and propaganda in all matters affecting the villagers' life.

#### ANTI-MALARIA OPERATIONS IN DELHI URBAN AREA, 1939 BY

*Lieut.-Colonel G. Covell, C.I.E., I.M.S.,  
Director, Malaria Institute of India*

As has been the case since 1936, malaria control measures in the urban area have been carried out under the direction and supervision of the Malaria Institute of India.

As regards permanent engineering works, the total sum sanctioned for this purpose in the financial year 1928-39 was Rs. 7,000. This was devoted to work on the Timarpur Sullage Farm, which had always been a prolific source of mosquito breeding, affecting in particular the Timarpur clerks' colony. The project consisted of three parts: (i) the diversion of sullage water by the construction of a masonry drain discharging into Najafgarh cut; (ii) levelling and dressing the whole area so as to drain it into the cut; and (iii) providing a sluice-gate under a raised roadway, which will act as a bund to prevent water being headed up into the area when the Jumna river is in flood. This project was completed during the year.

No provision was made for permanent works in the 1939-40 budget, but special sanction was given to use a sum of Rs. 34,000, representing savings from the city ditch project, for further very important work on the Bela. This included the raising of the bed of the terminal portion of the city ditch outfall, dressing and draining a triangular area between this and the Power House, raising the bed of the Fort Pukka Nala and fencing both this and Khairati Nala, with the provision of a bridge-crossing in each case. All this work has been completed during the year, representing a marked improvement in the condition of this part of the Bela.

#### ANTI-MALARIA OPERATIONS IN THE RURAL AREA OF DELHI PROVINCE

Abnormal weather conditions again prevailed. This made it impossible to assess fairly the value of the various measures adopted in controlling malaria.

##### *Operations in the 3-mile belt*

An overflow channel to the south of Quarry railway line has been provided during the year. Further, a new realignment of Kushak Nullah to the north of Quarry railway line has been taken in hand to drain the Kushak Nullah into the Chiraj Delhi drain which it is hoped will be completed during the year 1940-41. During the year under reference a sum of Rs. 16,050 from the funds was made available for this work. Improvement of surface drainage round Rajpur village has not been completed as the land had to be acquired from the owners. The work of filling and draining both sides of the old Najafgarh Road near the Darhalla Nullah has been completed.

Recurring measures were as follows:—

- (i) the issue of quinine for the treatment of malaria cases in 64 villages instead of 60. The four villages lying in the neighbourhood of Pusa Agriculture Institute were included during the year;
- (ii) anti-larval measures, including minor levelling, draining and the application of larvicides in 14 villages including 10 villages south of Quarry railway line and 4 other villages in the neighbourhood of Pusa Agriculture Institute;

- (iii) the spraying of adult mosquitoes was carried out in 15 villages as against 11 in the previous year. The quarters and huts lying in the new sewage farm were also included.

The results of these measures were determined by the spleen indices taken at the beginning and at the end of the malaria season (*i.e.*, June and December). For purposes of convenience the villages have been classified in three groups as follows:—

- Group A.—Villages which had quinine alone;
- Group B.—Villages which had quinine plus anti-larval measures;
- Group C.—Villages which had quinine plus adult spraying.

In group A there are 33 villages, 10 in the irrigated tract (north and north-west), 7 in the Bela or north-eastern tract which is subject to inundations from the river, and 16 in the dry tract which is subject to storm water flooding from the Ridge. Of these 33 villages, improvement in spleen index is apparent in 21 or 63.6 per cent; the proportion being 80.0 per cent in the irrigated tract, 43 per cent in the Bela and 62.5 per cent in the dry tract.

In group B there are 14 villages of which 10 are in the southern portion immediately south of old sewage farm, and 4 in the west in the neighbourhood of Pusa Agriculture Institute. In this group improvement in the spleen index is apparent in 10 or 71.4 per cent.

Finally there is group C in which there are 16 villages, 6 in the irrigated area, 5 in Bela and 5 in south-east of old sewage farm. The improvement in spleen index is apparent in this group in 10 or 66.7 per cent.

The cost per head of population works out as follows:—

Group A (Quinine alone)	..	-2/5 per head
Group B (Quinine and anti-larval measures)	..	-12/1 per head
Group C (Quinine and spraying)	..	-5/10 per head

#### ANTI-MALARIA MEASURES IN NAJAFGARH

The activities financed by the Indian Research Fund Association grant of Rs. 50,000 spread over five years were continued on the same scale as during the previous year with perhaps greater thoroughness and intensification as greater familiarity with the terrain was established.

The villages which were sprayed in addition to the other measures adopted displayed no appreciable advantage in so far as the reduction of spleen indices in villages not so treated was concerned.

##### *Operations in the rest of the Province*

No special personnel was employed outside the authorized health establishment. The measures taken were as follows:—(a) quinine distribution; (b) anti-larval measures including filling, levelling and draining around each village; (c) adult mosquito spraying.

#### MATERNITY AND CHILD WELFARE

##### *Urban*

Progress in New Delhi continues to be hampered by the lack of suitable centres. In the meanwhile owing to the impracticability of making use of the donation of Rs. 20,000 made by the Marchioness of Willingdon for an infectious diseases ward, this money, with Lady Willingdon's permission, is to be used for the construction of the badly needed centre in Jangpura.

In spite of the difficulties under which the Maternity and Child Welfare Services labour in New Delhi progress in many directions continues to be made. This can best be judged by the following summary:—

The number of confinements undertaken by the centres rose from 1,004 in 1938 to 1,218 in 1939. Excluding the confinements in the Lady Hardinge Hospital, the District Jail and in Viceregal Estate, those managed by the centres represent a proportion of 72 per cent as compared with 62 per cent in the previous year; while of the total births in New Delhi,

they represent a proportion of 37 per cent as compared with 38 per cent in the previous year. Attendances at the clinics rose sharply from 26,310 to 35,505 while the number of home visits rose slightly from 31,192 to 31,880. There were no maternal deaths amongst the cases undertaken by the centres—the maternal mortality for the rest of New Delhi was 3.32 per mille.

Only in infant mortality there has been a slight setback, the rate being 75 per mille in 1939 as compared with 65 per mille in 1938. On the other hand this compared favourably with the infant mortality rate for the whole of New Delhi which stands at 85 per mille, in itself a substantial improvement on the previous year's figure of 115 per mille.

Further improvement in the infant mortality rate in New Delhi can only be hoped for if the following conditions are fulfilled:—(i) better centres; (ii) more health visitors; (iii) improvement in the mobility of health visitors.

The centres in New Delhi continue to contribute their valuable quota of vaccinations, 1,183 operations having been performed in 1939, as against 287 in 1937.

Free milk was supplied to 190 indigent mothers. The issue of this important ingredient of the dietary of an expectant mother is fraught with certain practical difficulties.

The income from fees realized in New Delhi was Rs. 2,262 as compared with Rs. 401 in 1936 when the fees were charged on an even basis of 2 per cent of the husband's income. The rates were increased slightly in relation to the means of each individual's income and the return from fees has been rising steadily ever since.

The Mrs. Girdhar Lall Maternity Hospital was opened during the year. This institution although sited in New Delhi is not intended to serve any of the residents of New Delhi.

#### *Rural*

The area served by the centres has been considerably widened, and whereas in 1938 the staff of the three centres at Narela, Nangloi and Mahrauli dealt only with 548 cases of confinement, in 1939 they dealt with twice that number, namely, 1,088.

As regards infant mortality, the general rate in the rural area is of the order of 206 per thousand births, but on the other hand the rate amongst babies who are cared for by the centre staff is considerably lower. Maternal mortality amongst cases conducted by the centre staff is reported to be nil.

#### *Delhi Health Society*

The two centres maintained by this society at Sahibabad Daulatpur and Alipur continue to flourish and there is ample evidence to show how much they are appreciated by the villagers.

#### SCHOOL MEDICAL SERVICE

##### *Urban*

*New Delhi.*—The service established in the municipal schools continues to flourish.

There are two noteworthy features, namely, the introduction of inoculations against the typhoid group of diseases and the continued rise in the number of home visits. An explanatory pamphlet was circularized among parents and guardians and 1,756 children out of 2,670 accepted the offer. Of this number 1,238 received one dose and 518 two doses.

The number of attendances for treatment at school clinics in New Delhi has risen from 16,400 to 20,478 boys, and from 15,748 to 16,894 girls.

During the hot weather a special study was made of the effects of heat on school children. It was concluded that there certainly was evidence that the children were being subjected to a severe strain. Municipal Schools in New Delhi are accordingly closing in May and June this year as an experimental measure.

The scheme for the distribution of milk to school children continues with success. The number of school children paying for their milk was 180 as compared with 190 in the preceding year. In addition the Committee provided free milk for 100 indigent children per month, at a total cost of Rs. 1,664.

One interesting feature is the revelation that the greater number of dental defects occur among the more affluent classes than among the poorer classes. The explanation tendered is that the latter eat the coarser, less refined, and therefore less impoverished food, as for instance unhusked rice, coarse wholemeal atta, and potatoes cooked 'in their jackets'. Nothing eaten by the poorer classes is over-cooked, while the water in which vegetables are boiled is not thrown away but eaten.

No less than 579 boys and 603 girls were referred to the eye specialist during the year. Of these 245 boys and 239 girls were found to be free of any condition demanding treatment. The rest attended for treatment on 1,039 occasions, an average of 1.5 visit per case.

*Delhi City.*—The situation regarding the school medical service in Delhi City remains exactly as it was before.

*Notified Area Civil Lines.*—The number of attendances at the school clinic for treatment reveal that a very much larger number of girls than boys attended. The commonest complaint among the boys appears to have been minor surgical conditions as one would expect, while the predominating ailment among the girls was respiratory trouble—bronchitis, colds and sore throats.

*Rural.*—A smaller number of boys but a much larger number of girls attending schools in the rural area were inspected during 1939 than in previous years.

It is a matter of regret that no progress has yet been made in the matter of readjusting the school syllabus so as to include the teaching of hygiene on a compulsory basis if possible, from the earliest classes. The health staff in all areas have been active in lecturing to school children and in improving the sanitation of the schools, drinking water arrangements have been improved in most places and bore-hole latrines have been constructed. The district educational authorities have been very helpful in these improvements.

#### THE KING GEORGE V TRAVELLING RURAL DISPENSARY

In all, 808 villages were visited during the year and treatment for minor ailments was provided for 12,064 patients. In addition 43 magic-lantern lectures were delivered and the doctor in charge broadcast 3 talks for the village programme from the Delhi studio. Anti-cholera inoculations and vaccinations were performed. The travelling dispensary was also in attendance at the two fairs held in the province.

#### PROVINCIAL LABORATORY

Work carried out in the laboratory included examination of samples of water, chemicals, clinical material, and food.

The present food supply is 30 per cent adulterated and strict control is badly needed to improve the general health of the public.

#### ANNUAL REPORT ON THE HEALTH OF THE ARMY IN INDIA FOR THE YEAR 1939

THE health of the Army has been satisfactory and there have been no serious epidemics, although civilian areas amidst which troops are placed suffered extensively from cholera, plague, smallpox, dysentery, malaria and enteric fevers.

How vaccination and inoculation, sanitary control of cantonment areas and water supply save troops from smallpox and enteric fever, is seen from the fact that of smallpox there were only four cases in the whole of India amongst British troops and their families and



of enteric fever only one per 1,000 was infected amongst British troops, the incidence among Indian troops dropping to 0.5 per 1,000. Also there were no cases of cholera or plague amongst the military personnel.

Admission rates both for officers and men increased for British troops but the increase was more apparent than real owing to changes of strength.

Although the admission rate of 666.1 per thousand showed an increase of 63 per thousand on the previous year, the death rate and invalidating rate decreased and the quinquennial figures for admissions and deaths continued the fall obtained since 1920.

Amongst British soldiers malaria, sandfly fever and the dysentery-diarrhoea group were prominent. The insect-borne group, malaria, sandfly fever and dengue between them accounted for over 90 admissions per thousand of strength and for an increase of nearly 20 per 1,000 on the previous year. This was due in part to troop movements, early return to the plains and the manning of defensive posts in outlying unhealthy areas.

With an increase in the average of those constantly sick in hospital and an increase in barrack-treatment cases, the number of ineffectives increased from 52.27 in 1938 to 53.06 per thousand, but the total loss in working days was considerably less.

Among the principal factors affecting the health of the Army were many of the unusual movements of troops by train or road throughout the hot weather necessitated by the European tension culminating in the war. No casualties resulted from these moves. But an early return to the plains and manning of the defensive posts in unhealthy areas produced insect- and fly-borne infections. Operations in the early spring in Waziristan gave surprisingly low sick rates in spite of cold weather.

Spraying of living quarters as a defensive measure against all insect-borne diseases was further developed, often with success as in the reduction of sandfly fever in Peshawar and Rawalpindi districts. Arrangements were completed for manufacturing pyrethrum spraying solutions in our own medical stores depots from Empire grown pyrethrum flowers from Kenya.

There was no serious epidemic in the Indian Army and the rise in admission rates by 32 per 1,000 to the present figure of 454 per 1,000 is fully accounted for by conditions of war service. Large numbers of reservists returned to their units, hundreds of men returned from leave in and through highly malarious areas, there was a considerable influx of recruits, overcrowding was temporarily inevitable in many barracks, and many defensive posts had to be manned in unhealthy areas. Invaliding rates at 6.43 per 1,000 showed a small increase, but death rates fell to 2.12 per 1,000.

The increase in admission rates was due in great part to malaria, scabies, sandfly fever and the minor respiratory group, common cold and pharyngitis. The death rate of 2.12 per 1,000 continued the steady fall of the past fifteen years. Injuries with over 70 deaths and pneumonia were the commonest cause of deaths.

With the rise in average constantly sick the average sick time per Indian soldier increased but the average duration of each case decreased. The total inefficiency per day at 34.6 per 1,000 was slightly higher than that of the past two years but less than that of 1936.

As for the physical development of cadets in military colleges and schools, failures were few and the monthly increases in weight varied from 1½ to 2½ lb. per boy per month.

Barracks are being improved. The mosquito carrier is being eliminated by drainage, oiling, paris green powder, spraying with insecticides, 'dry day', 'sluicing' and above all by the use of larvicidal fish. Pasteurization of milk is being introduced in Southern and Eastern Commands.

In Northern Command 15 fully organized committees for co-operating with civil authorities are in existence.

Arrangements are being made for the provision of hygiene demonstration areas at every large station to form part of the brigade training scheme. Modern automatic chlorinating apparatus for purifying drinking water has been installed in one or two places.

## Correspondence

### ANTISEPTIC ANALGESIC TANNIC-ACID JELLY FOR BURNS

SIR,—I wish to put before you that I read an article in the journal edited by you of the month of 'February 1941' regarding the preparation of a jelly for burns given on 'page 121'. We tried to prepare the jelly—according to the formula given, but to our surprise instead of the jelly being formed only a solution was formed. Hence I shall be highly obliged if you will kindly let me know the exact method of preparation of the jelly.

*Civil Surgeon.*

CIVIL HOSPITAL,

AURANGABAD,

1st April, 1941.

[Note.—For tropical countries the percentage of pulv. tragacanth co. should be increased from 2 to 4 per cent. This is usually sufficient to make a more solid jelly; if not, a little agar or gelatin should be added.—EDITOR, I. M. G.]

## Service Notes

### APPOINTMENTS AND TRANSFERS

LIEUTENANT-COLONEL J. P. HUBAN, O.B.E., is appointed Additional Deputy Director-General, Indian Medical Service, with effect from the 28th February, 1941.

The services of Lieutenant-Colonel G. D. Malhoutra, Civil Surgeon, Moradabad, have been placed at the disposal of the Government of India, Defence Department, with effect from the 10th March, 1941.

Lieutenant-Colonel J. M. R. Hennessy, Civil Surgeon, Jubbulpore, has been posted to the Hoshangabad District with headquarters at Pachmarhi.

The Secretary of State for India has sanctioned the reversion to military employment of the following officers of the Indian Medical Service (Civil), with effect from the dates mentioned against their names:—

#### *Bengal*

Lieutenant-Colonel B. P. Baliga, 25th May, 1940 (forenoon).

#### *Bihar*

Lieutenant-Colonel G. H. Mahony, 9th May, 1940 (afternoon).

#### *Bombay*

Major B. S. Sandhu, 7th May, 1940 (forenoon).

The services of Major G. W. Miller are placed temporarily at the disposal of the Defence Department (Navy Branch), with effect from the 8th February, 1941 (afternoon), for employment as Principal Medical Officer, Royal Indian Navy.

On return from leave Major J. H. Boulton is posted as Civil Surgeon, Agra.

#### *To be Captain (on probation)*

Charles Sieveright Gamble. Dated 20th October, 1939, with seniority as Lieutenant from 20th October, 1933, and as Captain from 20th October, 1934.

The services of the undermentioned officer are dispensed with:—

INDIAN LAND FORCES  
(Emergency Commission)

Lieutenant Nirnanjan Choudhury. Dated 1st February, 1941.

INDIAN MEDICAL SERVICE (DENTAL BRANCH)

To be Lieutenants (on probation)

1st February, 1941

Mahmud Ahmad.  
Raj Sethi.  
Kartar Singh.  
Sheikh Nazeer Mohammad.  
Munawar Qureshi.  
Vere Oswald Arathoon.  
Joginder Singh.

LEAVE

Lieutenant-Colonel R. F. D. MacGregor, C.I.E., M.C., an Agency Surgeon, is granted an extension of leave on medical certificate for 6 months in continuation of leave sanctioned in previous notification, dated the 5th February, 1941.

PROMOTIONS

Colonel to be Major-General

H. Stott, O.B.E. Dated 23rd February, 1941.

Major to be Lieutenant-Colonel

J. McM. Wilder. Dated 28th March, 1941.

RETIREMENTS

Major-General H. C. Buckley, K.H.P. Dated 31st October, 1940.

Colonel E. S. Phipson, C.I.E., D.S.O., V.H.S. Dated 10th March, 1941.

Lieutenant-Colonel F. J. Anderson, C.I.E., M.C. Dated 10th March, 1941.

Lieutenant-Colonel D. P. McDonald. Dated 13th March, 1941.

Lieutenant-Colonel C. J. Lodge-Patch, M.C., Medical Superintendent, Punjab Mental Hospital, Lahore, who was on leave ex-India till the 18th February, 1941, retired from the service, on medical grounds, with effect from the 19th February, 1941.

RELINQUISHMENT

The undermentioned officer relinquishes his commission on the grounds of ill-health:—

INDIAN LAND FORCES  
(Emergency Commission)

Lieutenant N. Sitaraman. Dated 5th March, 1941.

## Notes

### DUST AND DISEASE

Dust is a recognized nuisance. It not only makes road travel extremely uncomfortable and sometimes dangerous, but is also injurious to health.

When blown about in the air, dust is the direct cause of many diseases. Dust infects the nose, throat and lungs, and may convey the causative organisms of tuberculosis, smallpox, dysentery and many other serious illnesses.

The simplest treatment is to water the surface of dusty roads, paths or courtyards. The effects, however, are only temporary and it is impossible to imagine the dust of thousands of miles of mofussil roads being kept down by artificial watering alone.

More permanent methods are to pave with stone slabs, lay cement or lime concrete, or surface with tar or asphalt.

The attention of our legislators should be drawn to this important question and provision made in the budget of every administration for the treatment of dust on roads.

(Extracts from a circular issued by the Indian Roads and Transport Development Association, Limited, 41, Nicol Road, Ballard Estate, Bombay.)

### 'TABLOID' 'EMOCIN' THROAT LOZENGE

AFTER tonsillectomy or in irritative and inflammatory conditions of the throat relief may be obtained by the application of acetylsalicylic acid to the seat of pain. The introduction of Tabloid Emocin by Burroughs Wellcome and Co., provides a newer and more satisfactory means of carrying out this treatment.

Each product contains two grains of Empirin acetylsalicylic acid combined with a flavoured demulcent base. Dissolved slowly in the mouth, Tabloid Emocin has prompt analgesic effect at the site of contact. On absorption, moreover, there follows a more prolonged action resulting from central analgesia.

Issued in tubes of 25.

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## Original Articles

### A STUDY OF RHINOSCLEROMA IN VIZAGAPATAM

By B. TIRUMAL RAO, F.R.C.S. (Edin.), F.R.F.P.S., D.L.O.  
Superintendent and Surgeon, Ear, Nose and Throat  
Department, King George Hospital

and

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Professor of Pathology, Andhra Medical College,  
Vizagapatam

#### Introduction

REPORTS regarding the incidence of rhinoscleroma in India are rare, though there is evidence that Chota-Nagpur is a well-defined endemic focus. A case is recorded by Castellani and Chalmers (1919) in an Indian coolie. Another typical Indian case has been figured by De and Chatterjee (1935). It seems probable that cases exist, but have not attracted sufficient attention from Indian workers. In East Asia, the Dutch Indies, especially Sumatra and Bali, are known endemic foci and the Dutch workers, Noosten, Kirschner and Vos (1934), Kouwenaar, Maasland and Wolff (1934), Snijders (1936), Wielenga (1937), and others regard the disease as affecting particularly ancient primitive indigenous races. An anthropological relation to the Munda and Kolar stock of Chota-Nagpur has been postulated. However, endemic foci are well known in Eastern Europe, particularly in Poland. Notification of scleroma was made compulsory in Poland in 1930 and in six years 562 cases were notified (Zaleswoki, 1938). In a general survey in Rumania, 36 cases were found (Metami and Tempia, 1930), mostly from the northern provinces. Cases have been reported from Russia, Germany, Austria, Hungary, Italy and Switzerland. On the American continent cases are met with in very small numbers affecting the whites as well as the negroes. South American foci have also been described. Cases also occur in Egypt and Algiers.

#### Cases for study

The following six cases encountered at King George Hospital, Vizagapatam, presented a typical clinical picture. In four of these, pathological examination revealed the characteristic histological changes in the tissues besides showing *Klebsiella rhinoscleromatis* that is constantly associated with the disease. Culture was carried out only in one case and it proved positive. Neither the complement-fixation test nor the skin reaction could be carried out. For purpose of histological examination besides routine methods of staining for cell picture, special methods were carried out for the demonstration of the organism in section. These included

Weigert's fibrin stain, Murray-Drew's stain and the methyl green pyronine method.

**Case 1.**—N. H., Hindu male, *æ*t. 40, from Ganjam District, admitted for nasal obstruction of ten years' duration. At first a small lump was found inside the nose at about its middle; this gradually developed in five years. There has also been difficulty in swallowing. The obstruction to breathing through the nose is complete. The pillars of the fauces are so closely approximated that only a narrow vertical slit is left for breathing. The patient takes liquid food with difficulty. A tumour of the size of a small lime, hard, nodular and slightly tender and irregular in outline is present at the philtrum. No laryngoscopy or posterior rhinoscopy could be done. Blood—Wassermann positive +. Nasal accessory sinuses opaque.

**Case 2.**—P. H., Hindu male, *æ*t. 30, from Vizagapatam District, admitted for swelling of the nose and obstruction to breathing of four years' duration. The skin surface of the nose is very uneven and hard; the tip of the nose is very much enlarged. The anterior nares is completely occluded, the upper lip is swollen and hard and the soft palate is similarly thickened. Blood—Wassermann negative. X-ray shows nothing definite except that the ethmoidal cells are opaque.

**Case 3.**—K., Hindu male, *æ*t. 25, from Berhampore, Ganjam District, admitted for swelling of nose of four years' duration with a history of having started with a discharge of pus and blood from the nose. He has been treated with salvarsan injections. The nose is flattened, the bridge broad, hard crusts which bleed on removal are found at the anterior nares which is very much stenosed. Blood—Wassermann negative. X-rays shows no evidence of any affection of bone. Posterior rhinoscopy showed some crusty purulent discharge.

**Case 4.**—D., Hindu male, *æ*t. 24, admitted for swelling of the nose and upper lips of two years' duration, and a history of having started with a growth inside the nose. It then extended outside the nose involving the upper lip in a symmetrical manner. This shows a butterfly-shaped ulcerating granulatory area involving and occluding both anterior nares and upper lip with a nodule in the left nares; soft palate and pillars of the fauces are thickened and hard, the arch is thickened and hard and the upper incisors loose. Posterior rhinoscopy shows a whitish nodular growth protruding from the posterior nares. Indirect laryngoscopy shows lingual tonsil slightly hypertrophied, vocal cords sluggish in movement. Blood—Wassermann positive. X-ray shows both maxillary antra opaque.

**Case 5.**—P. A., Hindu female, *æ*t. 50, admitted for obstruction to breathing through the nose of several years' duration. Alæ nasi, as well as tip, hard, indurated and swollen. The anterior nares is completely occluded. X-ray shows no evidence of involvement of sinuses.

**Case 6.**—S. S., Hindu female, *æ*t. 45, admitted for difficulty in breathing and ulceration of the nose of six years' duration. This started with bleeding from the nose and anosmia. The nose is broadened and flat and the anterior nares occluded. A firm, flat, reddish looking circular rupia-like growth covered with thin scabs is occupying the centre of the upper lip and extending to the dorsum of the tip of the nose; margin raised, slightly congested and firm; septum not discernible; soft palate hard and adherent to the posterior pharyngeal wall. Blood—Wassermann negative. X-ray nothing definite.

#### Pathology

The condition has been described as commencing primarily in the nose and spreading later to the nasopharynx or larynx. But the process may originate and remain more or less confined to the nasopharynx, larynx, or trachea. In this series, the origin in all cases appears to be in the nose, involving later the upper lip in all except case 3. The soft palate was involved

in case 4. In case 1 the faucial arch was involved so much, and so reduced by cicatricial contraction that only a small slit was left.

The pathological process has been divided into four stages (Boyko, 1940). The first stage is hardly distinguishable from atrophic rhinitis and a diagnosis is possible only by the complement-fixation reaction. In the second stage there is the formation of soft nodules of non-specific granulation tissue with predominance of plasma cells where the specific organisms are difficult to demonstrate. In the third stage the typical scleromatous infiltration makes its appearance and a typical histological picture becomes evident. The fourth stage is the stage of cicatricial contraction and deformity where the specific inflammatory tissue is replaced by fibrosis. In this series, cases 2, 3, 4 and 6 fall under stage three with the specific scleromatous deposit. In case 5 a biopsy could not be carried out. Case 1, though clinically typical, was in the stage of fibrosis where histological examination was of no value.

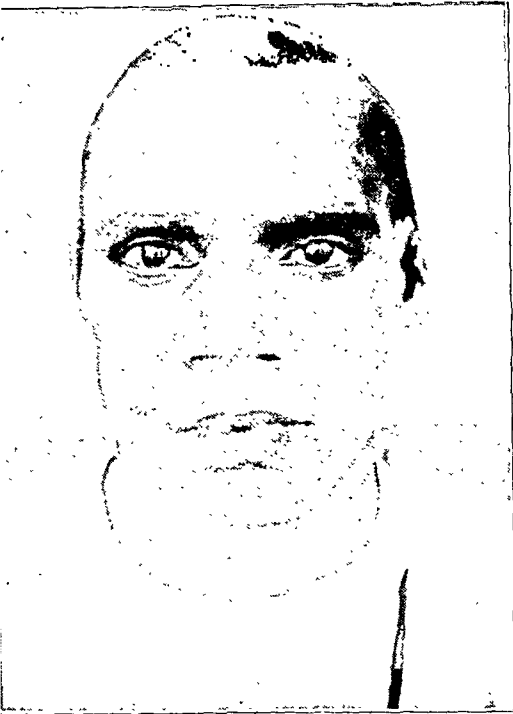
Histologically, case 2 showed a dense inflammatory granuloma under the surface epithelium. This extended deep down into the dermis involving the fibrous connective tissue so as to form a tumour-like mass of cells. Bundles of fibrous tissue walled off the growth and subdivided it into densely infiltrated cellular areas. The predominant cell type was the plasma cell with basophilic cytoplasm and cart-wheel nucleus. In places, the appearance was not unlike that of a plasma-celled tumour. A few of the plasma cells showed a faintly acidophilic cytoplasm, while others showed round acidophilic material in the form of large droplets in the cytoplasm—a degenerative change showing all the stages of the evolution of Russel's fuchsinophile bodies. The eosinophilic droplets increased in size and some fused together, so that the whole cell was converted into a large vacuole with a compressed distorted nucleus on one side. In others, the eosinophile droplets remained discrete, but increased in size, so that the whole cell resembled a cluster of grapes with an irregular nucleus in the centre. In between dense accumulations of plasma cells, there were fibroblasts and tissue histocytes with large vesicular nuclei, distinct nucleoli and prominent thin chromatin threads, an appearance not unlike that of proliferating endothelial cells. Polymorphonuclear cells were occasionally met with, especially towards the surface of the granuloma; lymphocytes and eosinophile leucocytes were few. Thick-walled young capillaries were occasionally met with, but were not so numerous as in granulation tissue. The characteristic histological feature, however, was the presence of large swollen mononuclear cells, 30 to 40 $\mu$  in size, with foamy cytoplasm, or with cytoplasm almost completely absent except for a few thin strands passing from the nucleus towards the periphery. The nuclei appeared compressed and irregular, being generally central in position

and sometimes at the periphery. These characteristic Mikulicz cells were filled with clusters of the capsulated bacteria, *K. rhinoscleromatis*, which could be well demonstrated by Wiegert's fibrin stain and the Murray-Drew method. Under low magnification, the Mikulicz cells appeared like large polyhedral vegetable cells giving a characteristic vacuolated appearance to the inflammatory tissue. In between all these differing cell types, there was a groundwork of delicate collagen fibrils, scanty in places and denser in other areas. The arterioles showed no endarteritis and caseation necrosis was not met with. The surface epithelium was intact and showed slight infiltration with polymorphonuclear cells.

Case 3 showed areas of an adenomatous proliferation of the nasal mucous glands. Surrounding the gland acini, however, was an inflammatory granuloma consisting mostly of plasma cells. Here and there nodules of lymphoid tissue were also met with and polymorphonuclear infiltration was more marked. Thick-walled capillaries were more numerous. Fuchsinophile degeneration of the plasma cells and the characteristic Mikulicz cells were present showing capsulated bacteria.

Case 4 showed positive smears and culture. Here the surface epithelium was thinned out and ulcerated and the whole dermis infiltrated by the granuloma. Under the low power, the foamy vacuolated appearance of the Mikulicz cells was characteristic. The histological appearance was similar, except for a more marked fibrosis. Degenerated plasma cells showing eosinophile bodies were common. Polymorphonuclear cells were few. An examination of the smear showed the organisms inside the swollen mononuclear cells. These were typical plump rods with rounded ends, Gram-negative and capsulated, lying in clusters inside the cytoplasm. Each cluster was surrounded by a vacuole where the cytoplasm of the cell had undergone degeneration. This appears to be due to the fusion of capsular material, for with increasing intracellular multiplication the vacuoles fused together and the whole cytoplasm appeared foamy giving rise to the characteristic empty appearance of the Mikulicz cell. A remarkable feature was the increase in the size of the organisms in the later stages of invasion of the cells. Thus, the early intracellular forms were about 1 to .4 $\mu$  in size, but in the later stages the bacilli were 1.5 $\mu$  in length and .6 $\mu$  in thickness. With rupture of the infected cells, each organism appeared larger from adhesion of the cytoplasm from the disintegrated cell. A comparison of the morphology of *K. rhinoscleromatis*, as met with in smears, with *K. granulomatis* of venereal granuloma showed that the small coccobacillary and typical diplo-bacillary forms of the latter (Menon and Krishnaswami, 1935) were not met with. *K. rhinoscleromatis* were distinct rod-shaped bacilli and on the whole were larger in size. The degenerative changes

PLATE XV



Case 3 showing the early stage of involvement of the alæ nasi. The skin is not ulcerated.



Case 6 on admission; the involvement of the alæ nasi and the upper lip is well marked.



Case 4 showing extensive ulceration involving the nose and the upper lip.



Case 6 showing the marked improvement with radium treatment.

PLATE XVI

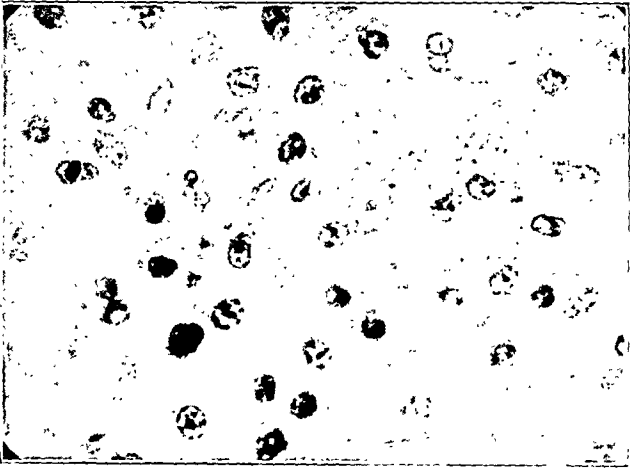


Fig. 1 showing numerous plasma cells and one large Mikulicz cell where the intracellular organisms are faintly visible (H. and E.  $\times 540$ ).

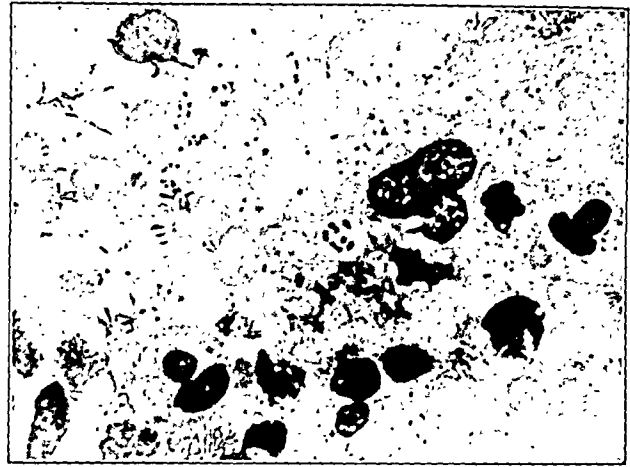


Fig. 3 showing the appearance of the early stage of *K. rhinoscleromatis* in a vacuole inside a swollen Mikulicz cell in a smear (Leishman's stain  $\times 540$ ).

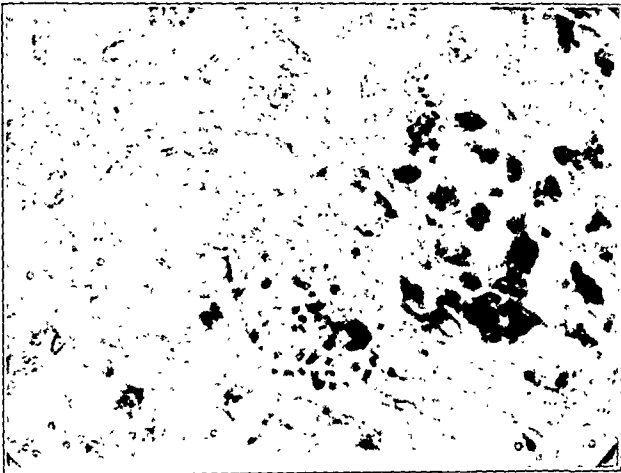


Fig. 2 showing the demonstration of the organisms inside the Mikulicz cell in a section by Weigert's Fibrin stain.  $\times 540$ .

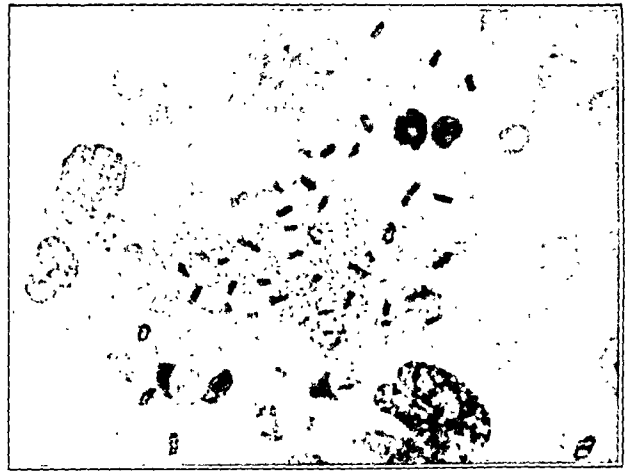


Fig. 4 showing the change in the morphology of the organism after intracellular multiplication and rupture of the cell in a smear (Leishman's stain  $\times 540$ ).

in the cytoplasm of the affected cell were more or less similar.

### Comment

The six cases in this series came from the Oriya-speaking tracts of Vizagapatam and Ganjam, all from the rural areas, excepting case 3 from the town of Berhampore in Ganjam District. They are all from the poorer strata of society, which accords with the observations of the European writers. It cannot however be said that any of these patients come from any of the primitive tribes. It has been said that several members of a family are often affected. But there is no history of any infection in the other members of the family in any of the cases in this series. Cases 2 to 6 present appearances which warrant their being brought under stage 3. Though case 5 left the hospital before a biopsy could be done, the gross clinical picture was very characteristic. Case 1 was the first to be diagnosed clinically as a case of rhinoscleroma. But repeated pathological examinations of the specimen did not confirm the clinical diagnosis, possibly because the condition had already reached the fourth stage of its progress.

With regard to symptomatology, the disease gives rise to a slow gradual and increasing obstruction to breathing and catarrh of the nose. While painless throughout, there may be some tenderness on pressure. The obstruction to breathing may become complete. When the larynx is involved there is cough, hoarseness, expectoration of crusts followed by dyspnoea, stridor and eventual stenosis. The trachea and bronchi are rarely affected. In all the six cases of this series, obstruction to breathing through the nose was more or less complete. In none of these was the glottis involved. In case 1 the fauces was reduced to such a small chink and the nasopharynx was so completely shut off by a diaphragm that there was difficulty in breathing that necessitated a tracheotomy. He was able to swallow only liquids. No characteristic smell as has been described by others was noticed in any of these cases. It is possible that the smell disappears in the later stages of the disease to which all these six cases belong. The long history, slow progress, absence of pain, stony hardness of the tissue, the dry secretion, absence of ulceration or destruction of bone, and other clinical appearances left no doubt as to the diagnosis.

With regard to prognosis, though the recorded cases in the literature show no cure by any method of treatment at our command, it has been noticed that the prognosis is good as regards general health unless marked stenosis interferes with respiration or deglutition. The six patients in this series were in fairly good health, including even case 1, in spite of his being forced to live only on liquid diet.

With regard to the method of treatment, satisfactory results have been reported only by treatment with roentgen rays or radium bromide

(Robinson, 1930; Mathers, 1935). In cases 1 and 2, radium implantation did not effect any improvement. In case 3 radium mould gave some relief. The anterior nares were dilated by means of rubber tubes. In case 4 radium (230 mg. hours) did not have any apparent effect on the condition. A course of urea-stibamine injections produced considerable improvement. In case 6 a course of foudin and neutral iodine were successively tried, but there was no improvement, however a final trial with radium gave very satisfactory results. The local condition was completely relieved. The anterior nares were dilated and the dilatation was kept up by keeping rubber tubes inside. At the time of discharge from the hospital the patient was able to breathe freely through the nose. The nasopharyngeal space was more roomy and the soft palate less dense and moving more freely. In case 1 in whom the Wassermann was positive, a course of N.A.B. injections was given with no apparent beneficial effect on the local condition.

### Summary and conclusion

1. Case reports of a series of six cases of rhinoscleroma coming from the Oriya-speaking tract of Ganjam and Vizagapatam who have been admitted to the K. G. Hospital, are presented.
2. The diagnosis was confirmed in all but two by histological evidence.
3. The improvement in the local condition by radium treatment has been demonstrated specially in case 6. A course of urea-stibamine in case 3 effected some improvement in the local condition.
4. The characteristic histological changes in the disease are also brought out; changes in the morphology of *K. rhinoscleromatis* are emphasized.

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## SOME OBSERVATIONS ON ENTERIC FEVERS

By WAMAN D. SULAKHE, M.B. (Bom.),  
M.R.C.P. (Lond.), F.R.F.P.S. (Glas.)

FROM Bombay Presidency about 5,000 to 8,000 cases of enteric fever are reported every year and Bombay city accounts for more than 2,000 cases out of them. There were two widespread epidemics here, one in 1937 and another in 1938. It is quite probable that actual incidence is much more than reported. Among the obscure types of pyrexia that are commonly met with in a general hospital in this country, the enteric group will probably account for the majority. So I propose to submit some observations on enteric fevers along with a study of 75 consecutive case-records of the disease admitted and treated in Sir J. J. Hospital, Bombay, during 1939-40, with the object of bringing to notice some of the atypical features of clinical and prognostic significance.

In the medical literature there are so many contradictory statements about the prevalence of enteric in the tropics. Manson-Bahr (1931) thinks typhoid to be the scourge of the young European in India and he ascribes the immunity of native races to typhoid as probably due either to mild attacks in childhood or to the immunizing effect of constant contact with the infection. While Lakin (1937) thinks that paratyphoid A is prominent in India, Minchin (1939) from Madras found only 2 cases of paratyphoid A and one case of paratyphoid B among 444 cases of enteric fever. Yodh reporting on 60 consecutive cases from a hospital in 1937 stated that in the present years, *B. typhosus* was the causative organism in most of the cases.

Even in temperate climates and in most of the countries with good sanitary conditions and a high standard of living, enteric fevers are endemic with occasional outbreaks of epidemic prevalence.

**Season.**—Cases generally occur at all times of the year. The maximum incidence in this series was shown in June, July and August.

**Age.**—Enteric is considered as a disease of early life—being fairly common in the first decade of life though rare in infants. This series only includes individuals above 14 years of age and the incidence was most frequent in the third decade of life with a progressive fall after 30 years, as will be seen from the following table :—

10-20 years	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years
19	26	19	7	3	1

**Sex.**—Males are attacked more frequently than females. In this series there were 67 males and 6 females.

**Community.**—The cases came from all communities and comparatively no single community was favoured with high incidence. This series includes no Europeans because most of them are treated in the European General Hospital.

**Pathogenesis.**—The enteric fevers are due to infection by *B. typhosus* and *B. paratyphosus* A, B, and C. The bacillus reaches the blood stream through the intestinal lymphatics and thoracic duct, thereafter it is localized to the reticulo-endothelial system in liver and spleen. From the liver it is transferred to the gall-bladder which carries it with its bile to the intestine to cause the pathognomonic typhoid ulceration in the intestines.

### Modes of onset

The usual classical onset is insidious, coming on slowly with malaise, frontal headache, insomnia, pains in the back and limbs and constipation or diarrhoea. There may be feeling of chilliness but hardly enough shivering to be called a rigor. Some cases do get epistaxis at the onset and there may be cough, dry in character. Along with these there is slight rise in temperature which does not come to normal for a week or so. The temperature progresses in a step-ladder-like gradation with evening rises and morning remissions. The pulse is usually slow and there is leucopenia. The tongue is covered with fur in the centre and the margins are clean and red. From the review of these 75 cases one is inclined to suggest that the most frequent mode of onset and certain symptomatic features are getting less common than before, as will be indicated in the following analysis.

The insidious type was found in 70 per cent (53 cases), the commonest symptoms being continuous fever, headache, backache and constipation or diarrhoea.

In 10 per cent (8 cases) the fever started with a definite rigor. The temperature maintained that intermittent character for 3 to 4 days after admission to the hospital, and thereafter assumed the continuous type. These cases gave rise to confusion in diagnosis, the blood films being negative to malarial parasites on examination. All these cases were admitted to the hospital earlier than other cases and got the advantage of hospital care which is so essential in this malady.

In 8 per cent (6 cases) there were patches of broncho-pneumonia consolidation in one or both lungs—there was dyspnoea and the respirations were hurried, but, along with these, there was distension of the abdomen with gurgling in the right iliac fossa and in some cases splenic enlargement, these features pointing to the necessity of further investigation to come to proper diagnosis.

Only one case came with lobar type of consolidation; this so-called 'pneumo-typhoid' type was rare. This agrees with the same infrequency stressed by Yodh (1937).

In 6 per cent (5 cases) the patients on admission were apathetic, semi-conscious, stuporose and suffered from low-muttering delirium. Some of these cases showed signs of meningism but on investigation with lumbar puncture no definite cytological or bacteriological evidence of meningitis was found. These were the cases who came to the hospital in the third week of the disease, being extremely toxæmic and difficult to treat.

Only one case came with jaundice as the presenting symptom, the jaundice being of the toxic-infective variety. The case proved fatal within 14 days. Jaundice occurring at the onset of enteric fever is very rarely mentioned in the literature but it is stated that jaundice of the toxic variety is not at all uncommon in private practice, in the proved cases of enteric fever. Jaundice occurring as a complication during the second or third week is quite conceivable, but its occurrence at the onset is rare; it seems therefore worth while making a note of it.

Another case came with flitting joint pains, excessive sweating and high fever; after 2 days of salicylate therapy without response, the temperature chart showed a continuous type of curve and the Widal reaction was positive (*B. typhosus*).

#### SYMPTOMS

Constipation is a fairly common symptom in enteric fever; it was present in 60 per cent of the cases of this series.

Diarrhœa at the onset is less common than constipation but a certain number of cases get this troublesome complication at the beginning of the second week. The cases coming as late as the 14th day come with diarrhœa and continuous pyrexia. Firstly, one has to exclude bacillary dysentery, and, secondly, this type proves refractory to all sorts of treatment by correction and limitation of the diet, large doses of bismuth orally, and opium in the form of starch and opium enemata. Diarrhœa is very exhausting to the enteric patient and these cases are likely ultimately to succumb from exhaustion or complications like hæmorrhage and perforation. In this particular series diarrhœa as a presenting symptom was present in 16 per cent of the cases (12), and out of these 5 proved fatal.

Cough is recognized nowadays to be a common accompaniment of enteric fever and there are found bronchitic signs in the lungs—cough was present in 80 per cent of the cases in this series (60 cases).

Epistaxis is mentioned in the textbooks as one of the common symptoms at the onset of enteric. Five per cent (4 cases) in this series gave a history of epistaxis before admission to the hospital. One case had recurrent epistaxis while in the ward.

Tongue—the typical 'typhoid tongue' with red clean margins and fur in the centre was observed in the majority (60 cases).

Pulse—slow pulse rate and its dicrotic character is often a differentiating point in favour of enteric fever as against some other acute infections, and is likely to prove fallacious in a certain number of cases. Thus, the pulse rate in more than 50 per cent (40 cases) in this series was 100 to 120 per minute. So slow pulse was uncommon in this hospital-class of patient; it must be mentioned that most of the cases came to the hospital after the first week.

Rash—the 'rose spots' are extremely uncommon in this country and on account of the dark complexion of the people it is very difficult to detect them. The rash was only mentioned in one case and that was very sparse, about 6 to 8 spots on the abdomen.

Spleen—was palpable in 25 per cent (20 cases); it was soft in consistency and tender on palpation.

#### DIAGNOSIS

Leucopenia is a constant feature of typical typhoid and is stated to be constantly present in uncomplicated cases. In this series of 75 cases, the white blood corpuscular count was done in 59 cases. It ranged from 3,000 to 18,000 per c.mm. It was below 5,000 in 24 per cent (18 cases) and was between 5,000 to 7,000 in 17 per cent (13 cases), and above 7,000 in 37 per cent (28 cases). So it will be noted that leucopenia, so constant a feature, was present only in less than half of the cases in this series.

*Blood culture.*—If the blood is taken during the first week, it is positive in most of the cases. The bacteraemia though transitory occurs intermittently and the blood culture is quite likely to become positive during the second or third week of the disease. In this series because most of the cases came late the blood culture was attempted only in 4 cases and in all those it was reported sterile.

Clot culture has proved of great value in the early diagnosis and has shown the causal organism in a fair proportion of cases before the agglutination reaction becomes positive (Soman, 1932; 1934). It was attempted in 21 cases and in 2 cases *B. typhosus* was isolated.

*Widal reaction.*—Agglutinins are generally developed in the blood 7 to 10 days after the infection. In some cases they do not develop until 6 weeks or may not appear at all throughout the disease. So the agglutination test may be positive in the first week and it is usually so in the second week. So a negative result in the first fortnight means little or nothing; if it continues to be negative after the third week, we may be required to revise our diagnosis. If the reaction is positive, it means that the patient either has enteric fever at the moment or has had it previously. Previous prophylactic inoculation gives rise to further difficulty. If the test is repeated and found positive in rising titre, it suggests active

infection. It is found that the inoculated person gives rise more commonly to 'H' type of agglutinins than 'O' type. 'O' titre 1 in 100 is taken as diagnostic and rising 'O' titre is still more confirmatory.

In this particular series the reaction was done in all except 5 cases where they came with complications and died within 48 hours after admission. Out of 70 cases, 25 cases (36 per cent) were reported negative repeatedly to *B. typhosus* and *B. paratyphosus* A and B. In 45 cases (64 per cent) it was positive in diagnostic dilution (1 in 100) on repeated observation, in 3 cases the reaction was positive to *B. paratyphosus* A and B in addition to *B. typhosus*. None of these cases offered any history of previous prophylactic inoculation. Only one case gave definite positive reaction to *B. paratyphosus* only. In 2 cases the patients gave a history of previous attack of typhoid, one case had a definite second attack with an interval of a month and a half. The case was treated and investigated under the same physician and was undoubtedly a case of recurrent attack. It is interesting because it is well recognized that one attack confers life-long immunity. Similar instances of two or three attacks of typhoid are mentioned in the literature (Box, 1937; Lakin, 1937). Bacteriologically all cases except one in this series were due to infection by *B. typhosus*. This finding in this series along with the results from Madras (Minchin, 1939) throws doubt on the statement that paratyphoid A infections are prominent in India.

#### COMPLICATIONS

**Hæmorrhage.**—This serious complication generally occurs at the end of second week when separation of sloughs begins. The incidence of this complication has been variously stated to occur in 3 to 8 per cent of the cases. In this series, this complication occurred in 3 of the cases (4 per cent); the amount of blood passed varied from a few ounces to large tarry stools. The hæmorrhage was brought under control by stopping all intake by mouth except normal saline, by repeated starch and opium enemata and by parenteral administration of calcium and hæmoplastic sera. But these patients had diarrhoea in addition and came very late in the course of the disease, as will be seen from the following table:—

Number	Duration of pyrexia before admission	Stay in hospital	
1	20 days	8 days	Died.
2	21 "	19 "	"
3	14 "	6 "	"

In all these 3 cases the diet was mainly liquid consisting of milk, buttermilk, whey, fruit juice, weak tea or coffee and arrowroot or

sago congee. In addition, the patients had glucose along with the feeds and by intravenous route. The total calories amounted approximately to 1,500 to 2,000 per day.

**Perforation.**—This most dreaded of the complications is fortunately rare. The incidence is stated to be 3 to 4 per cent. The fatality rate even after prompt surgical treatment is high and so its treatment remains chiefly preventive. In this series 2 cases came during the third week of the disease with definite evidence of perforative peritonitis, tenderness, board-like rigidity and obliteration of liver dullness. In one case there was localized suppuration in the peritoneum. This patient was operated upon soon after admission and perforation was found in the ascending colon. The second patient died before operation was resorted to.

**Pneumonic conditions.**—During the third week and subsequently, pneumonic conditions are fairly common. They may take any of the various forms such as hypostatic congestion, pneumonitis, broncho-pneumonic or lobar consolidation. These conditions occurred in 9 cases (12 per cent) in this series. It is apt to occur in those who were debilitated by age or previous disease. Of the 9 patients, 5 recovered and 4 died.

**Parotitis.**—This is due to ascending infection through the parotid duct. The hospital patients are apt to get it less frequently than those who are treated at home. Signs of inflammation of the parotid were recorded in 5 cases (6 per cent). All subsided after fomentations and with oral hygiene, except one where incision and drainage was necessary.

**Relapses.**—Relapse is a peculiar phenomenon very common in enteric fever. It is the repetition of the original fever, usually of a shorter duration and in a milder form. Relapses occurred in 4 cases (5 per cent), of these 3 had only one and one had two relapses. The interval was from 4 to 10 days and all the cases with relapses recovered.

The other complications that occurred were pyelitis in 4 cases, hyperpyrexia in 2 cases, cholecystitis in one, persistent hiccup in one, osteomyelitis of the tibia in one, and encephalitic syndrome in one. As sequelæ deafness and sacro-iliac arthritis were observed in one case each.

**Duration.**—Most of the cases came late in the course of the disease to the hospital. The duration of pyrexia before admission to the hospital ranged from 2 to 50 days, and the mean average was 10 days in this series.

The average duration of pyrexia after admission was 22 days and the average stay in the hospital about 30 days.

**Mortality.**—Even in England the death rate in enteric is stated to be from 15 to 20 per cent where the patients are in hospital quite early. In this series 19 patients out of 75 died. The

(Continued at foot of opposite page)

## BRUCELLA INFECTION IN VIZAGAPATAM

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BRUCELLA infection in man is present in some parts of India, especially the north-western region. Sporadic cases have been reported from several other parts; no definite case backed up by bacteriological or serological evidence has been so far reported from Vizagapatam.

Suspected cases of Brucella infection come under observation every year in the King George Hospital. During a period of 6 years ending 1939, the specific organism has been isolated from three cases and a high titre of agglutinins obtained in three others. Only those cases in which the sera gave agglutination reaction of 1 in 640 or more are included in this.

(Continued from previous page)

death rate was thus 25 per cent. Of the deaths, 9 were due to various complications and 10 died of toxæmia with cardiac failure.

## SUMMARY

Seventy-five case-records of enteric fever are examined and studied with a view to stressing the frequency of atypical clinical features. The majority of the cases were due to infection by *B. typhosus*. Maximum incidence was found in the months of June, July and August. The cases with diarrhoea at the onset showed a higher mortality than those with constipation. Slow pulse was an uncommon feature. Leucopenia was present only in less than half of the cases. Widal reaction was positive only in 64 per cent of the cases in diagnostic dilution on repeated observation. The death rate was 25 per cent.

*Acknowledgments.*—I am grateful to Lieut.-Colonel S. L. Bhatia, M.D., F.R.C.P., I.M.S., for permission to study these case-records and report them, and for many helpful suggestions.

I am also thankful to Dr. B. B. Yodh, M.R.C.P., and Dr. R. V. Sathe, M.D., M.R.C.P., for their kind help in preparing this paper.

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Typical clinical pictures were present in all these cases.

In all the six cases cultures were done with the patients' blood as well as urine. Blood culture was done as early as possible during the ascending period of a febrile bout. The time of taking blood was in the early afternoon just before the temperature had reached its acme. Two flasks containing 100 c.cm. of glucose broth in each were used for one blood culture and the quantity of blood inoculated into each was five cubic centimetres. One of the flasks was incubated aerobically and the other in an atmosphere of 10 per cent CO<sub>2</sub> tension. The cultures were not declared negative and discarded before the tenth day. In each case three such examinations were done on three consecutive days. The same procedure was followed in culturing urine, except that the time of culture was during the descending period of the febrile wave and the amount of inoculum was 20 c.cm. Early morning specimens drawn with aseptic precautions were chosen for the purpose. The medium used for subcultures was glucose agar. When a morphologically-suspicious organism was isolated its biochemical and metabolic characters were studied, but the identification was entirely based on the results of agglutination test with the specific serum (Burroughs Wellcome anti-melitensis serum). For this purpose, immediately the strain was isolated, suspensions of growth from solid media were made in 0.5 per cent phenol in normal saline and kept in the incubator for 24 hours. It was standardized to match the opacity tube containing 1,000 million *Bact. coli* per c.cm. (Topley and Wilson, 1936). This formed the antigen. The question of rough variants vitiating the result was kept in mind; so also the phenomenon of prozone.

Antigen for agglutination test with the patients' serum was also prepared in the above-mentioned way; two strains of melitensis and two strains of abortus were included in each. Care was taken to use only smooth strains. In the preparation of stock antigen in this laboratory, it is not usual to employ heat. Concentrated antigen was prepared and preserved in the refrigerator and suitably diluted just before use.

A modified Dreyer is the routine method of agglutination test adopted in this laboratory. The maximum dilutions employed in the test against Brucella organisms were 1 in 5,120. After the addition of antigen the racks were put in the water bath at 55°C. for 2 hours and the results were finally read the following morning.

The results of these tests together with short clinical descriptions of the cases are given below:

*Cases in which Br. melitensis has been isolated*

Case 1.—Hindu female, 13 years old, was admitted with a history of long-continued fever. Examination

for enteric, malaria, tuberculosis, etc., proved negative. The third blood culture turned out to be positive for *Br. melitensis*. The organism was also isolated later from her urine. Minute enquiry into the history elicited the fact that she had been taking goat's milk.

**Case 2.**—Hindu male, aged 22 years, butcher by trade, was admitted on 13th December, 1938, with a history of continuous fever of fifteen days' duration. Physical examination showed an enlarged spleen, slow pulse and leucopenia simulating typhoid fever. Widal reaction was positive in low titre for *Bact. typhosum*—1 in 80 (H). The temperature gradually came down to normal on 23rd December, but began to rise again. Taking it to be a relapse of typhoid fever, the Widal reaction was repeated on 26th December, when no rise in the titre was observed. From 31st December the temperature started swinging, but no significant change in the Widal reaction was forthcoming. However, the patient began to complain of pain in the joints and marked sweating every day. The provisional diagnosis was revised to undulant fever. Agglutination test on 10th January, 1939, gave a positive reaction for *Br. melitensis*, the titre being 1:1,280.

After touching normal a second time, the temperature started again, the third wave. Examination of blood showed 5,000,000 red cells, 6,250 leucocytes, and 70 per cent hæmoglobin. Blood agglutination on 25th January was positive for *Br. melitensis* at 1:5,120 and for *Br. abortus* at 1:1,280. Repeated blood cultures proved negative, but the fourth urine culture, on 26th January, was positive for *Br. melitensis*. The same organism was isolated from the urine drawn also on the following day. A persistent positive agglutination reaction in low titre against typhoid H antigen was an interesting feature of this case. He had no history of typhoid. He was given two injections of soluseptisine, followed on the next two days by prontosil tablets by mouth. The temperature came to normal on 31st January, and he was discharged cured on 6th February. Nothing significant was reported on subsequent enquiries.

**Case 3.**—Hindu male, aged 50 years, a butcher by trade, was admitted on 20th October, 1938, with a history of irregular fever of one month's duration. An enlarged liver and spleen were the only positive findings on physical examination. Blood smear was normal. Urine showed traces of albumin, few pus cells and occasional red cells. Blood culture was negative, but the serum reaction gave a positive result for paratyphoid A (H) in 1 in 640. The temperature touched normal on 16th November, and the patient was discharged next day.

On finding out that he was the father of the previous patient, we re-admitted him on 14th February, 1939, for further investigation. His liver was more markedly enlarged this time. Blood examination showed 5,000,000 red cells, 6,000 leucocytes—neutrophils 53 per cent, lymphocytes 29 per cent, mononuclears 4 per cent, eosinophiles 9 per cent, metamyelocytes 5 per cent and 90 per cent hæmoglobin. *Br. melitensis* antigen was agglutinated by his serum at 1:1,280 and *Br. abortus* at 1:160 and *Br. melitensis* was isolated from his urine. He was discharged on 18th February.

He was admitted a third time on 20th April, 1939, with a relapse. The temperature was irregular. Curiously enough the blood showed this time a high content of agglutinins against *Br. abortus*—1 in 5,120—but practically none against *Br. melitensis*. The patient was treated with hexamine by mouth and liver extract injections. The fever came down and he was discharged on 3rd June.

He was readmitted, for the fourth time, on 2nd July, as an emergency case for hæmatemesis. The temperature varied between 99° and 102°F. and he had four profuse bleedings in the ward. Gastric analysis, carried out after the acute symptoms subsided, revealed a normal curve. Albucid was given by mouth, 44 tablets in the course of ten days. He was free from symptoms and discharged on 23rd July. On 22nd

July, his blood agglutination was 1 in 2,560 against *Br. melitensis* and 1 in 1,280 against *Br. abortus*. This time attempts to cultivate the organism did not succeed.

Follow up shows that the patient is well.

**Serologically positive cases.**—In these, attempts to isolate the organism were unsuccessful.

**Case 4.**—Hindu male, aged 38 years, was admitted on 11th March, 1938, with a history of fever and pain in the right hypochondriac region of six days' duration. The only positive finding on physical examination was a slightly enlarged liver. After remaining continuous for the first few days, the temperature assumed an intermittent character with an occasional double rise. Examination of blood showed 4,000,000 red cells, and 6,400 leucocytes—polymorphonuclears 66 per cent, lymphocytes 30 per cent, mononuclears 1 per cent, eosinophiles 3 per cent; a few pigmented mononuclears were noticed. He had bleeding from the bowels twice. All diagnostic procedures were negative. Quinine and hexamine were administered with no effect. Liver puncture was done for Leishman-Donovan bodies with a negative result. He was given urea stibamine empirically but it had no effect. Agglutination test showed 1 in 640 (not end) for *Br. melitensis* on 22nd April. At his own request the patient was discharged on 25th April, with the temperature continuing.

He was readmitted on 23rd July with the same complaint as before. The enlargement of the liver was greater, 3½ inches below the costal margin and painful. He was put on a full course of emetine injections. The temperature came down but the enlargement of the liver persisted. He was discharged on 4th August.

Three months later he came to the out-patient department with arthritis of the left hip joint and was referred to the surgical side. His liver was still enlarged. In view of the presence of Brucella infection in Vizagapatam, his blood was again examined on 18th January, 1939, and gave a positive result of 1 in 2,560 for *Br. melitensis* and 1 in 640 for *Br. abortus*. This was a case of undulant fever, first undiagnosed and later diagnosed as amœbic hepatitis because of the enlarged liver without any enlargement of the spleen, and finally as *Br. melitensis* infection based on the result of the agglutination test. He had arthritis of the left hip as a complication.

**Case 5.**—Hindu male, aged 42 years, was admitted on 24th January, 1939, with a history of fever of two months' duration. Nothing abnormal was revealed on physical examination. The temperature was first continuous but later became intermittent. Blood picture was 4,500,000 red cells, and 3,600 leucocytes—polymorphonuclears 45 per cent, lymphocytes 44 per cent, mononuclears 2 per cent, eosinophiles 9 per cent. Repeated culture of blood and urine yielded no positive results but agglutination test with serum gave the following results: 25th January, positive for melitensis at 1 in 2,560 and abortus at 1 in 1,280; on 10th February, both 1 in 1,280. The patient was discharged cured. Agglutination test was done about ten months later (21st November, 1939), when it was 1 in 320 against *Br. melitensis* and 1 in 160 against *Br. abortus*. Subsequent tests showed a falling titre.

**Case 6.**—Hindu male, 60 years old, was admitted on 9th December, 1939, with a history of fever and pain in the joints of four days' duration. He is a wandering destitute usually living at Vizagapatam. He went to Khargpur from here and four days later he got fever and returned immediately to Vizagapatam and was admitted to this hospital. Physical examination did not reveal anything abnormal except a slightly palpable spleen. Temperature ranged between 99° and 103°F. and came down to normal at the end of ten days. After three days it rose again, became intermittent, and finally touched normal on 4th January, 1940. Blood and urine culture were unsuccessful; agglutination test was positive for *Br. melitensis* at 1 in 5,160 (not end) and for *Br. abortus* at 1:320.

*Discussion.*—The second case was diagnosed clinically as undulant fever and it was confirmed first by agglutination test and later by the isolation of *Br. melitensis* from the urine. This case led to the diagnosis of the third case, who is the father of the second case. The fourth case was first undiagnosed, but after the discovery of the presence of *Brucella* infection in this locality, he was traced and reinvestigated. He was proved to be serologically positive. The other two cases were clinically suspected and serologically confirmed.

The first four cases were from Vizagapatam, the fifth from Anakapalli and the last a wandering mendicant. Cases 2 and 3 are professional butchers of sheep and goats and the source of infection was clear, but in the others it was uncertain.

Two cases, cases 3 and 4, showed enlargement of the liver, and it was so prominent in both that amoebic hepatitis was suspected. *Hæmatemeses* in case 3 and bleeding per rectum in the fourth case showed the hæmorrhagic tendency in this disease. The temperature in case 3 continued for nine months and albugid apparently cured the condition. Possibly it was only a coincidence.

A preliminary investigation of the prevalence of *Brucella* infection in animals was started and a few specimens of blood were investigated. Meanwhile the veterinary department took up the question.

The only positive proof is the isolation of the organism. In clinically suspected cases a positive agglutination reaction in a high dilution, 1 in 640 or more, will help. This receives confirmation if the titre remains high or goes higher on repeating the test.

The last three cases are likely to be due to *Br. melitensis* and not *Br. abortus* as in them the agglutinin titre was considerably and persistently higher for *melitensis* than for *abortus*, although this is not a hundred per cent proof. It was noticed during these studies that the serum from certain types of pulmonary tuberculosis agglutinated *Brucella* antigen in low titre. It should also be remembered that the serum of apparently normal persons may agglutinate *Brucella* antigen up to a dilution of 1 in 100.

#### SUMMARY

1. Six cases of undulant fever were discovered in Vizagapatam.
2. *Br. melitensis* was isolated from three of the cases; the other three showed a high agglutinin titre against this organism.
3. Two cases occurred in butchers dealing with goats and sheep. In other cases the source of infection could not be traced.

#### ACKNOWLEDGMENTS

Our thanks are due to Dr. P. Kuttumbiah and Dr. N. V. Subrahmanyam. We are also thankful to the Director of King Institute,  
(Continued at foot of next column)

## NOTES ON AN EPIDEMIC OF INFLUENZA

By W. LAURIE

CAPTAIN, I.M.S.

IN late December 1940 an epidemic of influenza began in a camp on the N. W. Frontier of India. As this epidemic showed some interesting features it is proposed to give a report.

In view of the loose way in which the term influenza has been used, and in view of the fact that it was not possible to carry out the measures for diagnosis suggested in the *Medical Research Council Special Report No. 228* of 1938, I will begin these notes with a summary of the grounds on which my diagnosis was made.

On the 29th December, 1940, the sick parades of the units in the camp began rapidly to increase in number; the cause of the increase in the sick was almost wholly due to a condition which in the early stages showed signs and symptoms remarkably similar to those of sandfly fever, with the patients prostrated out of all proportion to the clinical findings. It was also observed that in addition to the patients who were so ill as to report on the sick parades, a large number of all ranks in the camp were complaining of 'severe colds'. The onset of the illness in all patients was very sudden, and sometimes remarkably severe as in the patient who died in the ambulance on his way to hospital from his lines, which were only five hundred yards from the medical inspection room. In the average patient, prostration of a greater or lesser degree was common, with fever, headache, and dulling of mental acuity, together with other signs and symptoms which varied according to the form of the disease; the large majority of the patients suffered from respiratory complications, this respiratory form of the disease accounting for over ninety per cent of all admissions to hospital during the epidemic; five patients of this group died. A small number of patients showed signs of the gastro-intestinal and nervous forms of the disease. Jaundice was a striking feature of those patients with gastro-intestinal complications.

On the above findings, and on the fact that I had not seen anything similar during two previous cold weathers in the camp, I decided that the epidemic was one of influenza. Subsequent post-mortem examinations confirmed the diagnosis.

The route along which the infection reached this camp also appears to have been traced. The

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Guindy, and to Mr. G. R. Viswanathan, the veterinary investigation officer of this presidency.

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camp (Razmak), practically speaking, is a terminus of the road, and movements into the camp are almost wholly military personnel with a small number of civilians; all these people come usually from the plains of India. The local people are not friendly, and movement of them into the camp is very limited; on account of the local political situation, for about four weeks prior to the beginning of the epidemic there had been very few arrivals from the plains, and practically no movement into the camp of the local population. Four days previous to the sudden rise in the illness of the camp personnel, however, an influx into Razmak of large reinforcements of troops from the Punjab and from the N. W. Frontier Province began, and it seems probable that these fresh troops brought the epidemic illness with them from the plains. There had been no epidemics locally.

It is therefore suggested that the illness was influenza and that it was brought from India.

Below is given the history of two of the patients; these histories may be taken as typical of the course followed by this disease in its attack on the respiratory system during this epidemic. These case-histories have been chosen also because they give details of a central nervous system complication, which was found with these patients.

*Case-history no. 1.*—Gurkha Rifleman, *et.* 22 years, five years' service. This patient was admitted on the 3rd January, 1941, complaining of fever and malaria-like rigors of two days' duration; he also complained of headache and of pain over the splenic area.

*Previous history.*—Malaria (benign tertian), 1934.

On admission the patient showed temperature of 100°F. with pulse rate of 100 per minute, and with 26 respirations per minute.

Patient did not appear seriously ill on admission; there was no prostration. The only abnormalities detected on clinical examination were tenderness of the spleen, two-finger enlargement of the spleen, and tenderness over the appendix area. Splenic puncture showed no trace of Leishman-Donovan bodies. The only abnormality in the stools was the finding of ova of *Ascaris lumbricoides*.

The respiratory system showed no abnormality.

The blood pressure was 120/80, with hæmoglobin 90 per cent, with the red cell count 4,600,000, with the white cells 6,000, and with the differential count showing polymorphonuclears 64 per cent; lymphocytes 32 per cent; monocytes 3 per cent; and eosinophiles 1 per cent.

One day after the patient was admitted into hospital ring forms of *P. vivax* were found in the peripheral blood. The patient was diagnosed as suffering from benign tertian malaria, and he was given 30 grains daily of quinine bihydrochloride, with 0.3 gramme daily of atabrin. With this form of treatment the patient's temperature and pulse rate returned to normal within forty-eight hours, *i.e.*, by the 6th January, 1941.

On the 7th January the patient complained of severe generalized pain and a cough. His temperature had risen suddenly to 101°F. with a pulse rate of 100 per minute, and with 22 respirations per minute. The patient's condition appeared to have changed markedly for the worse, with severe prostration. Repeated examinations of the peripheral blood for malarial parasites were negative. The patient showed marked dulling of the mentality with congestion of the conjunctivæ, with severe pharyngitis and with generalized bronchitis of moderate degree. The sputum did not show any distinctive change and the patient's cough

was not troublesome. There was no cyanosis. The predominant organism in the sputum was a hæmolytic streptococcus; *Hæmophilus influenzae* Pfeiffer was not isolated. Sputum was repeatedly examined for tubercle bacilli but always with negative results. Blood serum examinations against the Brucella group, against the enteric group, and against the proteus group were all negative.

The blood pressure had fallen to 100/75; the heart sounds were toxic in character. The white cell count was 8,400 with a differential leucocyte count showing polymorphonuclears 76 per cent; lymphocytes 18 per cent; monocytes 3 per cent; eosinophiles 2 per cent and mast cells 1 per cent.

The urine did not show any abnormality.

The patient was given grains 6 of quinine bihydrochloride intravenously without any effect on the signs and the symptoms. He was then diagnosed as suffering from influenza and was given symptomatic treatment.

By the next day, 8th January, the patient's condition was worse and he appeared dazed. On this day, the lungs did not show any sign of pneumonia but in view of the severe bronchitis and the danger of pneumonia, treatment by M. & B. 693 was begun. During the day, a total of ten grammes of this drug was given.

On the next day, the white cell count was 6,900 with polymorphonuclears 67 per cent; lymphocytes 26 per cent; monocytes 5 per cent; eosinophiles 1 per cent and basophiles 1 per cent. The temperature and the pulse rate had continued to rise, and at the base of the right lung there had appeared a very limited area of suppression of breath sounds; the toxæmia had increased. This worsening of the patient's condition was regarded as being due to the onset of an influenzal pneumonia, and another 14 grammes of M. & B. 693 was given.

By the evening of the next day, the 10th January, the patient had received a total of 35 grammes of M. & B. 693, the white cell count had fallen to 5,600 per c.mm. with a differential count showing polymorphonuclears 64 per cent, lymphocytes 24 per cent, monocytes 8 per cent, eosinophiles 3 per cent and basophiles 1 per cent. The temperature had risen slowly but steadily, the patient's toxæmia had increased, and fine râles were detected over that area in the right lung base where the breath sounds had been suppressed. In view of the steady deterioration of the patient's condition, with the continued reduction in the white cell count, and the increase in the severity of the toxæmia M. & B. 693 was stopped on the evening of the 10th January, the fourth day of the disease.

On the morning of the 11th January the patient developed incontinence of urine; when questioned as to why he had passed urine in bed he said that it came without his knowing anything about it. The only other abnormalities in the central nervous system were depression of the superficial reflexes and dulling of the mentality. This dulling was not sufficiently severe to prevent the patient realizing and becoming very worried about his incontinence. A lumbar puncture was done, and the fluid was found not to be under increased pressure nor was there any abnormality of the fluid.

On the 11th January the temperature began to fall, and by the 13th January it had reached normal. The urine did not contain any abnormal constituent, the cystoscope did not reveal anything abnormal, and the Wassermann reaction of the blood serum was negative.

This incontinence was not an overflow incontinence as the bladder did not at any time become distended. The urine appeared simply to run straight through the bladder as it reached it.

The incontinence of urine lasted for three days, passing off on the 14th January as quickly and as suddenly as it had developed.

The patient made an uneventful recovery and has not since had any difficulty in the control of micturition.

*Case-history no. 2.*—Maharatta Havildar, *et.* 32, 12 years' service. Patient was admitted into hospital on the 5th January, 1941, with complaint of generalized aching of the body, especially the large joints, frontal



headache of severe degree, and generalized weakness of three hours' duration; the attack had come on suddenly and had been ushered in by fever and a rigor. The patient said that the rigor was not like that of an attack of malaria. He also complained of a harsh troublesome cough with pain in the left side of the chest; this pain in the chest was said to be dull in character and to be increased by coughing and by deep breathing; the pain was present over an area corresponding roughly to that of the lower lobe left lung, and was particularly marked posteriorly.

*Previous history.*—Patient had had four attacks of benign tertian malaria in the previous four years.

On admission the temperature was 103°F. with a pulse rate of 100 per minute and respirations 22 per minute.

As was the case with the great majority of patients admitted with this disease, this patient on admission looked very like a case of sandfly fever, with a dazed expression, disinclination to talk, with languid movements and with marked congestion of the eyes. He was markedly prostrated. He showed coryza and his whole body appeared to be tender, especially over the limbs.

The tongue showed a thick white fur and the spleen was firm and one-finger enlarged; the stools did not show any abnormality.

The heart sounds were relatively slow in rate, but very toxic in character. The blood pressure was 100/65.

Hæmoglobin was 100 per cent; red cell count was 5,000,000; the white cell count was 8,800 and the differential leucocyte count was: polymorphonuclears 76 per cent, lymphocytes 17 per cent, monocytes 5 per cent, eosinophiles 1 per cent and basophiles 1 per cent. Blood films were always negative for malarial parasites.

The patient's cough was dry and barking and very persistent; sputum was scanty and not abnormal in appearance. There was a marked degree of granular pharyngitis and laryngitis. Both lungs showed generalized bronchitis and at the base of the left lung posteriorly there was a small area of medium crepitations below the tip of the left scapula. Pleuritic friction was not found. The predominant organism in the sputum was the pneumococcus. *Hæmophilus influenzae* Pfeiffer was not isolated, and repeated examinations for tubercle bacilli were always negative.

The urine did not show any abnormality.

In addition to the mental dullness the patient showed depression of the tendon reflexes.

The condition was diagnosed as influenza, complicated by very early broncho-pneumonia. Symptomatic treatment was ordered, together with M. & B. 693, of which 12 grammes were given on the first day of treatment.

By the next day, the 6th January, there was little change; another ten grammes of M. & B. 693 were given.

By the evening of the 7th January the patient had received a total of 30 grammes of M. & B. 693 but his lung condition had steadily worsened, with the lower lobe left lung showing changes suggestive of a patchy lobular pneumonia; he showed a septic type of temperature chart; the white cell count and the differential count had not changed to any extent. On the 8th January another 8 grammes of M. & B. 693 were given, but the patient continued to lose ground; on this day the cardiac condition was unsatisfactory, and coramine was given frequently from this date onwards until the patient died; this coramine undoubtedly was of real value and it seemed to delay the fatal issue.

By the 9th January, the toxæmia had increased very markedly, although the lung condition appeared to be smaller in extent than on the previous day. There was still no significant change in the white cell count and in the differential count. On this day administration of M. & B. 693 was stopped, a total of 40 grammes having been given without any obvious good results.

By this time the patient was very dull and disinclined to talk; the deep reflexes were no longer abnormal and the only abnormality of the nervous system other than

the dullness was that the pupils were both markedly dilated and reacted only sluggishly to light and to accommodation.

At noon on this day, the fifth day of the attack, the patient became doubly incontinent; rectal examination showed no abnormality; the urine showed no abnormality, and the Wassermann reaction of the blood serum was negative. Lumbar puncture was carried out; the cerebro-spinal fluid pressure was not increased and when examined the fluid did not show any abnormality. Blood culture was sterile and agglutination reactions against the *Brucella*, the enteric and the proteus groups were all negative.

During the afternoon of the 9th January the patient collapsed and the temperature fell to normal, but after an injection of coramine and other measures the temperature rose again.

By the 11th January, the patient was very ill, with intense toxæmia, with no change in the lung condition from the 9th January, when it was resolving, and with the mental dullness deepening into stupor; the heart sounds had become very toxic and fast.

On the eighth day of his illness the patient died. Double incontinence had persisted from the fifth day of illness.

#### *Post-mortem report*

*Summary.*—Tracheitis and bronchitis. Infiltration of brain and cord by small round cells. Sub-pleural and sub-pericardial hæmorrhages.

*Opinion.*—The post-mortem findings were not in themselves specific but they corresponded to the picture found in cases of influenza.

#### DISCUSSION

The first point which arises is the question of the incontinence; in one patient the incontinence was urinary and lasted only for four days, whereas in the other patient both the bladder control and the sphincter ani control were lost, and remained lost until death. No local cause was discovered by clinical examination, e.g., no abnormality on cystoscopic examination; no abnormality on rectal examination; urine showed no abnormality, cerebro-spinal fluid was not under pressure and showed no abnormal constituents, and in the nervous system the only other abnormality in addition to the incontinence was the dazed mental condition; this dazed condition was common to all the patients admitted into hospital for influenza during this epidemic. In spite of the dazed mental condition the men appreciated that they had become incontinent, and were greatly disturbed by this.

As has been pointed out by Osler (Osler and McCrae, 1930) that almost every form of disease of the nervous system may follow influenza, e.g., as long ago as 1898, at a meeting of the Bradford Medical-Chirurgical Society, Kerr (1898) demonstrated two patients in whom incontinence of urine had developed following influenza. Those influenzal lesions which are reported are usually severe and generalized, as was the case with Kerr's two patients. In such patients it is to be expected that the nervous tissue will show, at post mortem, marked and widespread damage, but in those patients who came to post mortem in this epidemic the changes in the brain and spinal cord, while showing in a mild degree the picture described by Boyd (1935), did not show

destruction to a degree sufficient to explain the incontinence on the basis of toxic damage to the spinal cord or to the more central portions of the nervous system. It is for this reason I report these two examples.

*The value of the sulphonamide group.*—The next point, of greater practical importance, concerns the value of the sulphonamide group of compounds in the treatment of influenza and of respiratory complications of influenza. In this epidemic eighty patients were treated by sulphonamide, M. & B. 693 being used.

Of the eighty patients suffering from respiratory complications of influenza and treated by M. & B. 693, in forty-nine patients the predominant organism in the sputum was the pneumococcus; the remaining thirty-one showed a predominance of streptococci. In no case was *H. influenzae* isolated. This prevalence of the pneumococcus was also noted by Malone (1921) who considered it to be a secondary invader and a potent cause of death in the 1919 epidemic in Bombay.

Largely as a result of research by American workers, it is now widely taught that the severe pulmonary complications of influenza are the result of invasion of weakened lungs by pneumococci, streptococci, and other nasopharyngeal organisms; for example, Price (1937) says 'it seems that many of the most serious and fatal cases (of influenza) owe their lethal character to virulent streptococci'.

In view of the proved value of the sulphonamide compounds in the treatment of non-influenzal streptococcal and pneumococcal diseases of the respiratory tract, it was hoped that this group of drugs would prove equally helpful in the treatment of the respiratory complications of influenza, but if our findings in this small series be typical of the results of sulphonamide therapy in respiratory influenza, then such hopes were not fulfilled. Even although in each of the eighty patients treated by M. & B. 693 the drug was given in full doses and given very early, it did not seem to have any beneficial effect whatsoever; the two case-histories given above are examples of this failure on the part of the M. & B. 693. The results obtained suggest that the sulphonamide group of drugs appeared to have no beneficial effect on the course of the disease, nor on the spread of the lung lesions.

There are other factors to be taken into account when deciding whether or not sulphonamide preparations should be given to patients suffering from 'respiratory' influenza; one factor concerns the white cells of the patient. Influenza is associated with leucopenia, even to the stage of so depressing the patient's white cell count as to produce temporary agranulocytosis, as in the patient treated by van der Molen (1939). It follows that any drug such as sulphonamide which may depress the white cell count should be of proved value in the

treatment of the disease, otherwise the extra risk is not justified.

Another factor to be borne in mind concerns the toxic effects of sulphonamide preparations; in the majority of patients suffering from influenza, the serious complications and many of the fatal outcomes are the result not of any local damage to the body or to one of its systems, but to the generalized toxæmia which is so characteristic of this disease. This is well illustrated by the prostration in the early stages of the disease, when local lesions such as pneumonia are at too early a stage to account for the generalized toxæmia. Again, therefore, it follows that if sulphonamide is not of real value in the treatment of influenza, it should be regarded as contra-indicated in view of the additional toxic effects which it may produce in a patient whose general condition is already markedly toxæmic. While this present series is too small to serve as a basis on which to give conclusions, it seems that further research is necessary to ascertain whether in respiratory influenza the advantages to be derived from the use of the sulphonamide compounds outweigh the disadvantages mentioned above. Our results suggest that the disadvantages outweigh the advantages. It was not possible to say whether this failure of the drug was due to the fact that the combination of influenza virus *plus* secondary invader changes the character of the secondary invader, or whether our present teaching is wrong when it holds that the influenza virus itself is not responsible for the respiratory lesions of the disease.

The last point concerns the effects of the influenza virus upon the circulatory system. In discussing influenza the majority of workers divide the illness into different forms, e.g., the pulmonary, the gastro-intestinal, and the nervous forms. In my opinion, however, clinical findings and the findings in the post-mortem room would indicate that the basis of all the pathology of this disease is the damage done to the circulatory system by the virus, for example Muir (1932), in discussing the lung lesions of the disease, mentions hæmorrhages in the lungs in influenzal pneumonia, and similarly Boyd (1935) in discussing influenzal lesions of the nervous system describes punctiform hæmorrhages in the brains of patients who have died of influenza. Certainly, if the sulphonamide preparations do prove of value in the treatment of influenzal pneumonia in spite of our findings to the contrary, then this classifying of influenza into forms would be justified, in so far as it would serve as a reminder that sulphonamide should be given in the respiratory forms of the disease. In the meantime, however, this classifying of patients suffering from influenza tends to obscure the important lesion requiring treatment, namely, the damage to the circulatory system.

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## TREATMENT OF SCABIES AND PEDICULOSIS WITH PYRETHRUM

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and

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In view of the unhappy position in which we are placed in regard to the treatment of scabies

(Continued from previous page)

In this series coramine was found to be of value, in contradistinction to the M. & B. 693.

## CONCLUSIONS

In this small epidemic of influenza it was found that the sulphonamide group of drugs appeared to have no beneficial action on the respiratory type of the disease, and unless other workers obtain more encouraging results I consider that the toxic side-effects of this group of drugs are sufficient to contraindicate the use of the drugs of this type in the treatment of this disease. I consider that the underlying lesion which is of the greatest importance is the serious damage which influenza produces on the circulatory system.

I am unable to offer any explanation for the incontinence found in the two patients whose case-histories are given above.

## SUMMARY

A small epidemic of influenza is reported, in which two patients developed incontinence, one showing incontinence of urine, and the other showing double incontinence.

Respiratory complications were not benefited by the administration of M. & B. 693.

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and as scabies and pediculosis have assumed positions of considerable importance in the present conditions under which both civilians and troops are living in Great Britain, we think it worth while publishing a short account of our observations on the effect of pyrethrum on simple scabies and pediculosis or when complicated by secondary infections.

It was recognized during the last world war that conditions of pyoderma, e.g., impetigo, boils, etc., had an important relationship with scabies. The pyrexia of unknown origin in its common form of trench fever was a sequel of pediculosis, and/or scabies.

## Scabies

Scabies is extremely common in this country and occurs chiefly during the winter. Textbook descriptions of this disease are seldom met with among patients attending the hospital outdoor department as by the time they seek medical relief, extensive involvement of the body has already taken place. It is not uncommon to find itch on every part of the body except the face and the head, resulting in conditions which it would be difficult for an inexperienced observer to diagnose. The secondary pyoderma is also extensive and is generally of a varied nature. Many patients find it difficult to move and are completely crippled for the time being.

A very large number of remedies have been recommended for the treatment of scabies. Of all remedies, sulphur in its various forms is generally acknowledged to be the most efficient and the rate of cure in severe types of scabies which was met with in France in the last war was 31.7 days as against 3 days for the average early case.

We have no personal experience of treatment of this disease by benzyl benzoate. We have, however, used a 10 per cent ointment of finely powdered flowers of *Pyrethrum cinerariaefolium* with vaseline not only in human scabies and pediculosis but also in mange in rabbits and dogs and the striking success we have met with in these diseases in all our clinical trials has prompted us to bring it to the notice of the medical profession with a view to its wider application.

Earlier records show that pyrethrum in the form of an ointment has been used by Sweitzer (1936) in scabies. As we have had no access to his original papers, we are unacquainted with such details as the strength of the ointment used, the types of scabies in which it was tried, etc. However, he regarded this ointment as a clean, effective and valuable remedy.

**Method of application.**—The freshly prepared ointment should be well rubbed on the parts of the body affected by itch, especially in the evening, and once again before retiring to bed. The itching is generally relieved within 48 hours after its application. When secondary infection has set in, it is advised that the pus should be first let out before the parts are washed with

soap and hot water. As soon as the skin is dry the ointment should be applied in a thick layer. Very marked improvement is generally noticed within 48 hours after its application even in severe types showing considerable inflammation of the affected parts. If the instructions are carefully followed patients who have been crippled on account of severe inflammation will be able to undertake their usual avocations after 3 days.

What direct effect pyrethrum has on the organisms responsible for secondary infections, it is difficult to say. It is nevertheless true that after its application the ulcers show signs of healing within a remarkably short space of time.

It is not possible for us to state the average period needed for cure. As most of our patients were treated in the out-patients' department, we were not able to keep in touch with them till they were absolutely cured and the last trace of the disease had disappeared.

*Ill effects.*—We have not so far come across any bad effect following its application even practically over the whole body. It also does not cause any irritation of the conjunctiva when applied on the eyelids.

### *Pediculosis*

Lice are commonly found in this country on the hairs of the head especially in women of the lower classes and in beggars, who have generally uncleanly habits. They are also not uncommonly found on European and Anglo-Indian school girls who do not wash their hair daily. The other form of pediculosis due to *Phthirus pubis*, though not very rare, is sometimes met with among all sections of society.

The symptoms caused by their presence are merely local irritation, and complications mentioned in textbooks are rare.

In louse infestation either by *Pediculus humanus capitis* or by *Phthirus pubis*, application of pyrethrum either in the form of a pomade or a watery extract is followed by equally beneficial results. As soon as the pyrethrum comes in intimate contact with the louse, the latter becomes at once inactivated and is soon killed. The fundamental basis of treatment therefore is to lay stress on the point that whatever preparation is used, it must be well rubbed into the hairs to ensure this contact.

### *Pediculus humanus capitis*

*Method of application.*—The pomade is prepared with white vaseline in 8 to 10 per cent strength and is applied once in the evening. The application is to be continued for 5 days in succession which is generally taken as the incubation period of eggs (the incubation period of eggs in Calcutta during winter months is from 7 to 10 days). It should be noted that pyrethrum has no effect on nits but post-embryonic stages are quickly acted upon by it.

The watery extract is prepared by soaking 2 oz. of coarsely powdered pyrethrum flowers in about 20 oz. of water for half an hour, and thereafter heating it in a water-bath short of boiling point for another half hour. It is particularly useful in women who have long hair, and who are unwilling to apply any greasy material to their hair. Although the watery extract is slower in its action than when pyrethrum is used with vaseline, it nevertheless contains toxic properties powerful enough to kill the post-embryonic stages of this insect.

As much of the hair as possible should be immersed in a bowl containing the extract and the rest of the hair should be treated with a sponge soaked with the fluid. The treatment must be continued once daily during the incubation period of the nits.

### *Phthirus pubis*

In connection with the action of the ointment on the crab louse we would like to refer to two cases, both boys aged 6 years and 8 years respectively, who were admitted in the hospital for some other disease in addition to infestation of the eyelids by crab lice. At the time of their admission they had blepharitis, conjunctivitis and severe inflammation of the eyelids following the infestation. Application of the ointment on the eyelids twice a day was quickly followed by recovery in the course of 3 days.

### *Discussion*

Castellani and Jackson (1915) stated that pyrethrum powder had a very feeble action on lice. We carried out experiments on identical lines with pyrethrum grown in Japan, Kenya and India, the pyrethrum content of various samples varying from 0.5 to 1.5 per cent and found that all insects were killed within half an hour. The ointment however acts very quickly. In fact, death may occur almost immediately after its application. The watery extract acts more slowly and it takes about 3 hours for the insects to die. When vaseline is replaced by an oil, its action is uncertain.

According to Castellani and Jackson (1915) vaseline, lard and lanoline are all efficacious in themselves. According to our observations they act mechanically by blocking the spiracles of the insects. Pyrethrum, on the other hand, has a pronounced toxic action. When simple vaseline is used, the action depends on the number of spiracles which are completely blocked. While a louse will be killed almost instantly when it is immersed in vaseline, a small quantity when applied on its dorso-lateral surface, has either no action at all or the insects are not affected for 3 to 4 hours. In the case of pyrethrum ointment the action is certain and takes place quickly.

We have intentionally left out the question of reinfection in scabies during the course of pyrethrum treatment. Reinfection may take

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## A NOTE ON THE TREATMENT OF RELAPSING MALARIA

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and

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AFTER an ordinary course of quinine, in at least 60 per cent of cases of benign tertian malaria infection, a relapse occurs. There are some patients who persistently relapse, under conditions where the possibility of reinfection can reasonably be excluded. When such a case is encountered, one should first make sure that the drug—quinine, other cinchona alkaloid, or atabrin—is actually being taken in the doses prescribed, and, secondly, that it is being absorbed; this can be ascertained with a reasonable degree of accuracy by testing the urine by the Tanret-Mayer test in the former two cases and by the Tropp and Weise (1933) method\* in the last. If the drug is being absorbed, there is no reason why the oral route should be abandoned in favour of any other route, *e.g.*, intravenous or intramuscular, and little will be gained by increasing the dose beyond the usual 10 grains three times a day or prolonging the

\* Add 2.5 c.cm. of 60 per cent NaOH and 25 c.cm. of ether to 50 c.cm. of urine; shake well and separate the ether; to the latter add 5 c.cm. of N/10 hydrochloric acid. The atabrin is extracted by the acid and the intensity of the yellow colour will be in proportion to the atabrin content.

*(Continued from previous page)*

place either from the patient himself or from an infected person or object, such as bedding, garments, etc. The female mite is a 'cave dweller' and lays from 15 to 20 eggs during her lifetime. The eggs hatch in 5 or 6 days. Transmission usually occurs at night when the acari are most active. Reinfection therefore depends on the destruction of eggs, larvae, nymph and adults for which extensive and continued treatment of the patient for at least a week after cure is necessary. In addition to this, complete disinfection of articles of clothing and bedding, that may have become contaminated, should be advised.

Pyrethrin, the active principle of pyrethrum, is an unstable compound and should under no condition be exposed to sunlight. It should also be freshly prepared.

It should be remembered that if pyrethrum is used, only *P. cinerariaefolium* should be selected.

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(Abstract, *Arch. Dermat. and Syph.*, 1937, **35**, 719.)

course beyond 10 days (if the cinchona alkaloids are being used, or 0.1 g. thrice daily for 7 days if atabrin is the drug).

Recently, such a patient came under our charge in the hospital. Details of the case are given below:—

The patient, a European male, aged 27 years, was admitted to the Carmichael Hospital for Tropical Diseases on the 1st October, 1940, complaining of sickness, headache, and pains in the joints and left side of chest with a temperature of 102.2°F.

The history was that he came to India in September 1939, since when he had seven attacks of malaria. During the first attack he was given quinine by mouth, as well as by six intramuscular injections. During the second attack he was treated with a course of atabrin and plasmochin. For subsequent attacks he was given quinine or atabrin with or without plasmochin, under medical supervision; he did not remember the details of doses. His last attack was in the first week of September, when he was given quinine, 30 grains a day, for 10 days.

The present illness started on the 27th September with fever and rigor, which recurred every alternate day. His spleen was enlarged one inch below the costal margin and was tender; the liver was just palpable. No other abnormality was detected. He had pain on the left side of chest which was apparently due to splenitis. Blood examination showed scanty benign tertian parasites.

On the following day, the temperature was normal, but the blood smear showed scanty trophozoites.

He was left without any specific treatment until the 5th October when he was given alkalies (sodium bicarbonate gr. 15 and sodium citrate gr. 30) followed half an hour later by a mixture containing 10 gr. of quinine, three times a day, with plasmochin 0.01 gm. twice a day for 10 days. On the 11th day (16th October) he was given an injection of sulpharsenol, 18 centigrammes, intramuscularly. Next he was given a 'tonic' mixture, with liquor arsenicalis—*mix*, twice a day after food, for one week. On the 23rd he was given a second injection of sulpharsenol—24 centigrammes. During this period he was getting a slight temperature of about 99°F. in the evening. The blood was therefore examined by a cultural method for malarial parasites; the result was negative. He was however given another course of quinine, gr. x, twice a day for 7 days from the 24th. Subsequently, he was completely afebrile. The second course of quinine was followed by a third injection of sulpharsenol—30 centigrammes. During this period the patient definitely felt a sense of well-being and gained 5½ pounds in weight.

He was discharged after 32 days in hospital, with a recommendation for a change of climate for a few months. He was instructed to inform us should he get another relapse.

He remained entirely free from fever for more than 6 months and gained another stone in weight.

*Comment.*—It was shown by Acton as early as 1919 that quinine acts on the malarial parasites best in an alkaline substratum, and the alkaline treatment of relapsing benign tertian, sometimes called Sinton's treatment, is dependent on this fact.

The addition of plasmochin in small doses to the ordinary course of quinine has been shown to reduce the relapse rate considerably (Sinton and Bird, 1928).

During the last war, on account of the shortage of quinine, the Germans used salvarsan in the treatment of malaria. In the Balkan countries, where the type of malaria is very resistant

*Blood counts:—*

Date .. .. .	2/10/1940 (on admission)	25/10	1/11 (on discharge)
Hæmoglobin, g. per 100 c.cm. .. .. .	13.75	15.4	16.5
Erythrocytes per c.mm. .. .. .	4,500,000	5,260,000	5,440,000
Reticulocytes, per cent of red cells .. .. .	0.1	0.6	0.1
Mean corpuscular volume-cu. $\mu$ .. .. .	91	83.9	86.7
" " hæmoglobin $\gamma\gamma$ .. .. .	30.5	29.1	30.3
" " concentration per cent .. .. .	33.4	35	34.9
Leucocytes, per c.mm. .. .. .	4,500	8,000	..
Polymorphonuclears, per cent .. .. .	55	..	..
Lymphocytes " " .. .. .	28	..	..
Monocytes " " .. .. .	12	..	..
Eosinophiles " " .. .. .	5	..	..
Van den Bergh test— .. .. .	..	..	..
Direct .. .. .	Neg.	Neg.	—
Indirect (bilirubin in mg. per cent) .. .. .	0.4	< 0.25	—

to treatment, the combining of arsphenamine drugs with quinine has long been the practice.

In the treatment in this case, and in other similar cases, we have combined these three devices for enhancing the specific action of quinine. In our experience, any one of these measures proves more efficacious than the old practice of subjecting the unfortunate patient to a very prolonged course of quinine, or the, unfortunately, common one of resorting to intra-muscular injections.

Another point which this case exemplifies is the constant slight anæmia that is associated with a latent, comparatively inactive, malarial infection in which there is little evidence of hæmolysis (bilirubinæmia = 0.4 mg. per cent; reticulocytes 0.1 per cent), and the subsequent recovery of the blood picture after the anti-malarial treatment.

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# THE SIGNIFICANCE OF THE TAKATA-ARA REACTION IN THE DIAGNOSIS AND PROGNOSIS OF HEPATIC CIRRHOSIS

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THE Takata-Ara reaction was first introduced by Takata (1925) as a laboratory test for differentiation between lobar pneumonia and broncho-pneumonia. In the same year, Takata and Ara (1925) working on spinal fluid introduced a modification of the test, affording a differentiation between the syphilitic and meningitic types of spinal fluids.

The value of this test in the diagnosis of hepatic cirrhosis was first mentioned by Staub (1929); Jezler (1929) tried this test on blood serum and found that it produced a flocculation in the great majority of cases of hepatic cirrhosis. This paper deals with its value in the diagnosis and prognosis of hepatic cirrhosis.

*Material employed.*—Specimens of blood serum and ascitic fluid were used for the tests. Only non-hæmolysed samples of blood serum and clear samples of ascitic fluid were used. Specimens arriving late in the evening were stored in the refrigerator until next morning, when the test was performed.

*Technique.*—A slight modification of the method described by Ragins (1935) was employed. Briefly it was as follows:—

A series of dilutions of 1 in 2 to 1 in 256 of the blood serum or ascitic fluid was made in a set of eight tubes with 0.9 per cent sodium chloride. To 1 c.cm. of the diluted serum or ascitic fluid, 0.25 c.cm. of a 10 per cent solution of sodium carbonate was added and thoroughly mixed. 0.3 c.cm. of freshly prepared Takata-Ara reagent (consisting of equal parts of 0.5 per cent solution of mercuric chloride and 0.025 per cent solution of basic fuchsin) was added to each tube and the contents well shaken.

The presence or absence of a flocculent precipitate in the tubes was noted. Three readings were taken, the first after 5 minutes, the second after  $\frac{1}{2}$  to 1 hour, and the third after 24 hours. Reactions were recorded as 3 *plus* (strong positive), 2 *plus* (moderate positive) and 1 *plus* (weak positive) doubtful and negative according to the density of the precipitate and the rapidity with which it appeared. No reaction was considered positive unless there was a fairly well-marked precipitate in at least three of the first six dilutions.

Altogether, blood sera and ascitic fluids from 117 cases were examined. I have divided them into three groups, for convenience, as follows:—

Group I consisting of 51 cases of hepatic cirrhosis.

Group II consisting of 11 cases most of which showed evidence of derangement of liver function, but had not been diagnosed as hepatic cirrhosis.

Group III consisting of 55 cases (control), suffering from a variety of diseases not specially connected with any derangement of liver function.



*Group I*

This consisted of 49 cases clinically diagnosed as hepatic cirrhosis and two other cases (nos. 82 and 91), which from the clinical signs and symptoms, noted below, were highly suggestive of a condition of hepatic cirrhosis.

Case 82 was a male, aged 30 years, admitted with a history of ascites of 4 months' duration. He had been admitted into hospital a month previously for a similar complaint and had been tapped. He was tapped on 31st August, 1939. The abdomen filled up rapidly and he was tapped again on 6th September, 1939, and was discharged. The diagnosis of the case was 'ankylostomiasis and secondary anaemia'. The rapidity with which the peritoneal cavity filled up after tapping and the number of occasions on which he was tapped are highly suggestive of a condition of portal obstruction due to hepatic cirrhosis. The Takata-Ara reaction was +++.

Case 91 was a male, aged 32 years, admitted with a history of distension of the abdomen for 3 years—*caput medusae* present. The spleen was enlarged 4 inches below the costal margin. The liver was not palpable. Shifting dullness and fluid thrill were present. Twenty-one pints of fluid were aspirated from the peritoneal cavity. The total protein content of the ascitic fluid was 1.3 per cent. The Takata-Ara reaction was +++.

The diagnosis was 'ascites'. This was probably a case of hepatic cirrhosis. The results of the Takata-Ara reaction in these 51 cases are given in table I.

TABLE I

*Fifty-one cases of hepatic cirrhosis*

Strong positive Takata-Ara reaction ..	33 cases
Moderate positive .. .. .	9 "
Weak positive .. .. .	5 "
Negative .. .. .	4 "

*Group II*

The second group consisted of 11 cases all showing evidence of liver derangement, but not diagnosed as hepatic cirrhosis. The clinical diagnosis and the results of the Takata-Ara reaction in these cases are given in table II.

TABLE II

*Takata-Ara reaction*

Clinical diagnosis	+++	++	+	Doubtful	Negative	Total
Ascites .. .. .	1	1	..	..	2	4
Ascites and jaundice .. .. .	..	..	..	1	..	1
Chronic malaria with ascites (case 20) ..	1	..	..	..	..	1
Syphilitic cirrhosis of liver .. .. .	..	..	..	..	1	1
Acute yellow atrophy .. .. .	1	..	1	..	..	2
Infantile biliary cirrhosis .. .. .	1	..	1	..	..	2
<b>Total ..</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>11</b>

The clinical notes of some of the cases are interesting.

Case 20 was a male, aged 20 years, admitted with a history of fever, pain in the joints and ascites. The duration of the ascites was 10 days. The duration of the other symptoms has not been clearly noted; it was probably longer. The spleen was enlarged four fingers breadth below the costal margin. The liver was just palpable. The Takata-Ara reaction was +++.

diagnosis was 'chronic malaria with ascites'. An early cirrhosis of the liver is a possibility in this case.

Case 52 was a male (age not mentioned) admitted into the Government Headquarters Hospital at Coimbatore on 26th March, 1939, with a complaint of intense jaundice, restlessness and delirium. Two days previously patient returned from work complaining of aching pain all over the body and jaundice was noted. Since that night, he developed restlessness and delirium. The pulse ranged from 88 to 110. No diminution of liver dullness. Lungs: *nil* abnormal. Urine contained bile pigment. The motions were clay coloured. The patient was taken away by the relatives on 31st March, 1939, against medical advice. No history of having taken arsenic or other medicine. Diagnosis: 'acute yellow atrophy'. The Takata-Ara reaction was weakly positive.

Case 85 was a male, aged 29 years, admitted with ascites, oedema, jaundice and irregular fever. He had taken a purgative 4 days previously for abdominal discomfort. Subsequently he noticed swelling of the abdomen and later, of the legs. Ascites was well marked. Five pints of fluid were removed from the peritoneal cavity. The liver was palpable two fingers breadth below the costal margin and pulsating. The spleen was not palpable. The patient died in hospital, developing intense jaundice. The diagnosis was 'toxic hepatitis, acute yellow atrophy'. The Takata-Ara reaction was +++.

Case 34 was a male child, aged 3 years. It was a case of infantile biliary cirrhosis. The Takata-Ara reaction was weakly positive, both in blood as well as in the ascitic fluid on three different occasions. The blood of the mother of the child gave a negative Takata-Ara reaction.

Case 151 was a male child, aged 5 years, clinically diagnosed as biliary cirrhosis. The Takata-Ara reaction was +++.

The latter four cases, *viz.*, two cases of acute yellow atrophy and two cases of infantile biliary cirrhosis, suggest that in conditions of hepatic insufficiency also, the test is positive. The clinical notes of the other six cases in this group are not available.

*Group III**Fifty-five control cases*

This group consisted of 55 control cases suffering from a variety of diseases, not specially connected with any derangement of liver function, two were cases of Banti's disease; the

other 53 were cases whose blood specimens were received at the Institute for Kahn and Wassermann test. This included latent syphilis, chronic gonorrhoea, kala-azar, leprosy, cardiovascular diseases, tumours, nervous diseases, and so on. Of these, both cases of Banti's disease gave a negative reaction. Of the rest, 45 gave a negative reaction, one a doubtful, two a weak



positive, one a moderate positive, and four a strong positive reaction. These cases are tabulated in table III. Of the two weak positives, one (case 21) was a case of chronic kala-azar, where a certain amount of hepatic insufficiency may be expected. The other case was

disease of the heart. The positive reaction in this case was probably due to a certain amount of hepatic insufficiency as a result of chronic venous congestion. The liver was enlarged to a level of about 4 inches below the costal margin. There was ascites and œdema of the legs.

TABLE III

*Forty-seven cases (two cases of Banti's disease and forty-five control cases)*

			TAKATA-ARA REACTION.						REMARKS.
			+++ 3 plus	++ 2 plus	+ 1 plus	± Doubtful	- Negative	Total	
Banti's disease ..	..	..	..	..	..	..	2	2	
Kala-azar (case 21) ..	..	..	..	..	1	..	..	1	
Syphilis—									
Congenital ..	..	..	..	..	..	..	1	..	
Primary sore ..	..	..	..	..	..	..	1	..	
Latent ..	..	..	1*	..	..	..	7	..	
Gummata ..	..	..	..	..	..	..	2	..	
Spinal ..	..	..	..	..	..	..	1	13	
Chronic gonorrhœa ..	..	..	..	..	..	1	..	1	
Leprosy ..	..	..	..	..	..	..	2	2	
Cardiovascular diseases—									
Congenital heart disease ..	..	..	..	..	..	..	1	..	
Cardiac insufficiency ..	..	..	..	..	..	..	2	..	
Aneurysm ..	..	..	..	..	..	..	1	..	
Syphilitic myocarditis (case 107).	..	..	..	1	..	..	..	..	
Hyperpyæsis ..	..	..	..	..	..	..	2	7	
Gastro-intestinal diseases—									
Duodenal ulcer ..	..	..	..	..	..	..	1	..	
Ulcerative colitis ..	..	..	..	..	..	..	1	..	
Chronic diarrhœa ..	..	..	1*	..	..	..	..	3	
Enteric fever ..	..	..	..	..	..	..	2	2	
Nervous system—									
Spastic paraplegia ..	..	..	..	..	..	..	1	..	
Polyneuritis ..	..	..	..	..	..	..	1	2	
Tumours—									
Tumour abdomen ..	..	..	..	..	1	..	..	..	
Tumour ovary ..	..	..	..	..	..	..	2*	..	
Multiple bone tumours ..	..	..	..	..	..	..	1	..	
Cancer of the tongue ..	..	..	..	..	..	..	1	..	
Tumour clitoris and vulva (case 23).	..	..	1	..	..	..	..	6	
Other diseases—									
Chronic eczema ..	..	..	..	..	..	..	1	..	
Polyarthrititis ..	..	..	..	..	..	..	1	..	
Cholecystitis ..	..	..	..	..	..	..	1	..	
Hæmorrhagic ascites ..	..	..	..	..	..	..	1	..	
Anæmia ..	..	..	..	..	..	..	1	..	
Mothers of two cases of infantile biliary cirrhosis.	..	..	..	..	..	..	2	7	
No diagnosis ..	..	..	1*	..	..	..	..	1	
			4	1	2	1	39	..	
								47	cases

diagnosed as 'tumour abdomen' but no other clinical notes were available.

The case with a moderate positive reaction (case 107) was one of chronic venous congestion of the liver, as a result of chronic valvular

Of the four cases giving a strong positive reaction, there are no clinical notes available in three. The fourth (case 23) was a female, aged 25 years, with a history of purulent vaginal discharge for 3 years and a tumour at

the base of the clitoris involving also the right labia and perineum. There were enlarged inguinal and epitrochlear glands. The condition of the liver was not mentioned. No conclusions can be drawn from these four cases.

*The total protein content of the sera and ascitic fluids investigated*

In 17 cases this investigation was done. In six of these, the relative albumin-globulin ratio is available. In the other 11 the total protein content only is known. The results are given in table IV.

TABLE IV

Case number	Serum albumin * or total protein, per cent	Serum globulin, per cent	Percentage of globulin to total protein	Takata-Ara reaction
19	0.65 *	0.50	43.5	Negative
25	0.80	..	..	"
56	0.36 *	0.44	55.0	"
78	0.50 *	0.15	23.1	+++
83	0.12 *	0.08	40.0	++
84	1.60 *	0.20	11.0	+
91	1.30	..	..	+++
95	0.40 *	0.05	11.0	+++
98	0.15	..	..	Negative
102	0.60	..	..	+++
134	0.65	..	..	+++
137	0.40	..	..	+++
138	0.35	..	..	+++
141	1.70	..	..	+++
143	0.65	..	..	Negative
146	0.40	..	..	+++
147	0.70	..	..	+++

In case 19 the blood serum was examined. In the other cases the ascitic fluid was examined.

*Relationship between the gel test and the Takata-Ara reaction*

Hassan and Salah (1939) in a series of 600 cases found a similarity between the formol-gel test and the Takata-Ara reaction. They state, however, that the formol-gel test could be relied upon to detect sera with hyperglobulinæmia, if such sera contain 4 per cent or more of globulin, and that both tests are influenced to a certain degree by the lability of the serum proteins.

In 29 cases which gave a positive Takata-Ara reaction the gel test was done on the blood sera and ascitic fluids. The results are given in table V.

TABLE V

Takata-Ara reaction.	GEL TEST	
	Positive	Negative
Strong positive. 23 cases ..	5	18
Moderate positive. 2 " ..	..	2
Weak positive. 2 " ..	1	1
Negative. 2 " ..	..	2
TOTAL 29 cases ..	6	23

Though the number of cases in this series is small the results show that there is no definite relationship between the two tests.

*The relationship between Kahn, Wassermann and Takata-Ara reactions*

The three reactions were compared in 82 cases. The results are tabulated in table VI. The results show that there is no relationship between the Takata-Ara reaction, and the Kahn and Wassermann reactions. This finding is in agreement with the work of Tannenholz (1933).

*An interesting case with a negative Takata-Ara reaction (case 69)*

R., female, aged 24 years (with masculine features such as a fine growth of a beard and moustache), was admitted into hospital for ascites of one year's duration. Hepatic cirrhosis was suspected. The serum was examined for the Takata-Ara reaction. She was tapped thrice and the ascitic fluid was similarly examined on all three occasions, but the test remained persistently negative. Laparotomy revealed a tumour of the right ovary. On section it was found to be an arrhenoblastoma. The liver was found to be normal. There was no recurrence of ascites and all the masculine features disappeared after the removal of the tumour.

*Factors involved in causing the flocculation*

The Takata-Ara reaction is caused by the interaction between the mercuric chloride and the serum protein as a result of which a colloidal solution of mercuric oxide is thrown down as a flocculent precipitate. It has been stated by Takata (1925), Nicole (1929), and Jezler (1930) that it is 'the decreased stability of the serum proteins of the colloid system which makes the precipitation of the colloidal solution of mercuric oxide possible and this is due to the increase of globulin with an inversion of the albumin-globulin ratio'. According to Nicole, Takata and others (*loc. cit.*), it is the albumin which exerts a protective action, thus preventing the flocculation of the colloidal solution of mercuric oxide. In a number of cases in my series, there was no flocculation in the tubes containing the first and second dilutions. In many cases a flocculation occurred in these tubes at the time of making the test but redissolved in a few minutes, or in 1 to 2 hours, leaving the tubes clear. Maximum flocculation occurred in the tubes containing the third, fourth and fifth dilutions. It is possible that this phenomenon is due to the high concentration of albumin in the first and second tubes which exerts a 'protective effect' and prevents the flocculation of the colloidal mercuric oxide. The phenomenon is probably analogous to the zone phenomenon in the Widal test.

The normal albumin-globulin ratio of the blood serum is stated to be 2 : 1, and when this ratio is reversed or altered, a positive Takata-Ara reaction is said to occur. Nevertheless, the test may be completely negative while there is an increase in the globulin fraction or a decrease in the albumin fraction (Hassan and Salah, 1939). Jezler states that in his series of cases

TABLE VI

Takata-Ara reaction	KAHN			WASSERMANN		
	Negative	Weak positive	Strong positive	Negative	Weak positive	Strong positive
Strong positive (22 cases) ..	12	1	1	5	1	2
Moderate positive (7 cases) ..	4	1	..	..	1	1
Weak positive (3 cases) ..	1	..	1	..	..	1
Doubtful (1 case) ..	..	..	..	..	..	1
Negative (49 cases) ..	17	3	4	14	3	8
TOTAL (82 cases) ..	34	5	6	19	5	13

of positive reactions, the percentage of globulin to the total serum protein was higher than 55, whereas in the negative cases the percentage of globulin to total serum protein was about 37. Ragins, however, points out that, in his cases of positive reactions, the percentage of globulin was less than 37. In my series, out of four positive cases, only one gave a globulin percentage of 40. The other three gave percentages of 23.1, 11, and 11, respectively. Two negative cases gave globulin percentages of 43.5 and 55. It is, therefore, obvious from these contradictory observations that the chemistry involved in the reaction is obscure. It is probable that the reaction depends upon a qualitative change in the nature of the globulin.

#### Conclusions

According to Ragins, the reaction is positive in 98 per cent of cases of hepatic cirrhosis. 'That this reaction is of value in decompensated liver conditions due to cirrhosis is beyond doubt. For latent liver damage, the test is not entirely reliable'. He also tried the test in various other conditions such as renal and cardiovascular diseases. In the great majority, they were negative except in cases where liver insufficiency was co-existent.

In my series of 51 cases of hepatic cirrhosis, only four gave a negative reaction. The other 47 (92.2 per cent) gave a positive result. As mentioned previously, six other cases (four cases in the second group and cases 21 and 107 in the third group) in which evidence of liver damage was present, gave a positive reaction. There is, therefore, some evidence that a positive result is indicative of deranged liver function.

*The practical utility of the test.*—In cases of undoubted hepatic cirrhosis, where there is 'failure of compensation' as indicated by ascites and other symptoms, the test is not of much value from the prognostic point of view, but when there is no ascites or other evidence of 'decompensation' the test may be of value in detecting cases of cirrhosis in the early stages, when energetic treatment may be applied.

#### Summary

1. The Takata-Ara reaction has been performed in 117 cases including 51 cases of hepatic cirrhosis; only four of these 51 cases gave a negative reaction.

2. In six other cases where there was evidence of liver damage, the test was positive. The test is therefore of value in the diagnosis and prognosis of hepatic cirrhosis and hepatic insufficiency.

3. Out of 55 control cases only seven gave positive results, but two of these showed evidence of liver damage. In the other five, liver damage cannot be totally excluded, as no clinical details are available.

4. The technique of the test is described. Its simplicity warrants its extensive use in hospitals and laboratories.

5. There is no definite evidence that the test depends upon an increase of the globulin in the blood serum or ascitic fluid. The chemistry of the reaction is still obscure.

6. There is no striking relationship between the Takata-Ara reaction and the gel test. The Takata-Ara reaction has no relationship to the Kahn and Wassermann tests.

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## PROTHROMBIN TIME IN HEALTH AND DISEASE\*

(ACCORDING TO QUICK'S METHOD)

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and

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RECENT advances in basic sciences supply a satisfactory explanation of the defects in the mechanism of coagulation of blood and suggest valuable methods for the laboratory diagnosis and therapeutic control of some of the most baffling clinical conditions, namely, hæmorrhagic diseases.

*Recent advances in physiology*

Dam (1934; 1935) observed that chicks on synthetic diets developed hæmorrhages uncontrollable by vitamins A, C and D. He therefore attributed the bleeding tendency to lack of a specific food factor, vitamin K (coagulation vitamin). Dam and Schonheyder (1934) demonstrated that the delay in coagulation in chicks on diets deficient in vitamin K was not caused by a disturbance in the levels of fibrinogen, calcium or the cellular elements of the blood or the thrombokinase of the tissues. Dam, Schonheyder and Tage-Hansen (1936) subsequently showed the element deficient in the blood of these chicks to be prothrombin.

Investigations along a different line have thrown new and valuable light on the significance of the above researches. Numerous studies relating to the coagulation defect in jaundice had revealed that bleeding in jaundice was not due to a disturbance in fibrinogen, calcium, or formed elements, or in any other easily studied component of clotting mechanism. Only one component in blood, prothrombin, remained to be still investigated. Quick (1935; 1937; 1938) devised a method, simple but specific, to determine blood prothrombin and also succeeded in demonstrating a prothrombin deficiency in

jaundiced patients with hæmorrhagic tendency. Warner, Brinkhous and Smith (1936) have developed a more accurate but somewhat complicated method. Recently, a third method has been employed and advocated by Dam and Glavind (1938; 1940).

Two interesting findings are disclosed by the above studies. The first is that the prothrombin level is constant for each species. The second is that ordinarily the level of prothrombin is much in excess of the physiologic requirements, providing for large losses. Serious hæmorrhages do not occur until 80 per cent of prothrombin is lost and the blood prothrombin sinks below 20 per cent.

With the aid of these newer methods for the determination of prothrombin, it has become possible to gain further information regarding the stages in the synthesis of prothrombin by suitable experimental procedures on animals and by investigation of clinical conditions, with frank hæmorrhages or in suspected cases of hæmorrhagic diathesis.

*Hypoprothrombinæmia produced by surgical procedures in animals*

(A) *Biliary fistula*.—Dogs with bile fistula develop spontaneous hæmorrhages. Greaves and Schmidt (1937) demonstrated that prothrombin could be markedly lowered by either ligation of bile duct or by making a biliary fistula. They also observed a hæmorrhagic tendency in rats with bile fistulæ. These animals had a low level of prothrombin by Quick's method. Bile is necessary for the adequate absorption of fat-soluble vitamins. Absence of bile in the intestine leads to impaired absorption of vitamin K with resulting lowering of plasma prothrombin. Both the hypoprothrombinæmia and hæmorrhages were quickly controlled by administering adequate amounts of bile salts along with the usual diets.

(B) *Experimental liver damage*.—Smith, Warner and Brinkhous (1937) reported a marked drop in blood prothrombin in dogs subjected to prolonged chloroform anæsthesia. Partial hepatectomy also reduced the prothrombin level. Total hepatectomy in dogs and rats was followed by a rapid decline of prothrombin. In rabbits, a hæmorrhagic tendency was observed after artificially produced fever (severe hepatic necrosis?).

In view of these findings, it may be concluded that liver is essential for the formation of prothrombin and that the concentration of prothrombin is reduced in all conditions with extensive parenchymatous damage to the liver. It is also assumed that the liver is concerned in the conversion of vitamin K (derived from diet or from the action of intestinal bacteria) into prothrombin. In the jaundiced patient, the reduction of prothrombin may be due either to inadequate absorption from the bowel or faulty utilization by the damaged liver or to a combination of both defects.

\* Paper read before the section of Physiology during the 28th Annual Session of the Indian Science Congress, Benares, 1941.

(Continued from previous page)

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The purpose and programme of this work may be said to be threefold—

(1) The choice of a suitable method for the study of the anomalies of coagulation and hæmorrhagic diseases.

(2) The determination of prothrombin time in normal healthy adults.

(3) Observations on the variations in prothrombin time in various diseases.

#### *Choice of the method or technique*

In order to select an accurate, widely-used and well-established technique, a good deal of time was spent in wading through the extensive and rapidly increasing literature on the various laboratory procedures found useful in the study of the defects of coagulation and hæmorrhagic diathesis. Local conditions, laboratory facilities at our disposal, and the growing handicaps due to the difficulties in obtaining new apparatus and new chemicals, imposed severe restrictions on our choice. We had reluctantly to abandon all hope of starting work on the very accurate method of Warner, Brinkhous and Smith and even on the simpler method advocated by Dam and Glavind. After reviewing our present facilities and taking account of the future uncertainties, we decided to study the possibility of using Quick's method in our work. It is now well recognized that patients whose coagulation time and bleeding time is normal, as judged by the usual tests, may still develop hæmorrhages, particularly those with jaundice and biliary tract disease. It is in such cases that the new test devised by Quick reveals a potential impairment of clotting and gives a danger-signal warning against the possibility, nay probability of hæmorrhages. Quick's method is therefore a definite improvement over the older methods now in use in the hospitals and laboratories.

#### *The principle and technique of Quick's test*

The method is based on the assumptions that the rate of coagulation is a function of the concentration of thrombin and that the production of thrombin in oxalated plasma is proportional to the concentration of prothrombin, if an excess of thromboplastin is present and an optimum amount of calcium is added. The clotting time according to this method is a direct measure of prothrombin content.

Four and a half cubic centimetres of blood obtained by venepuncture is mixed immediately with 0.5 c.cm. of M/10 sodium oxalate solution and centrifuged. 0.1 c.cm. of plasma is pipetted into a clean dry test-tube and is mixed with 0.1 c.cm. of thromboplastin solution prepared according to Quick's directions. The test-tube is kept immersed in a water-bath at 37°C. for a few minutes and then 0.1 c.cm. of M/40 solution of pure anhydrous calcium chloride is quickly added. The contents of the tube are now rapidly shaken while immersed in the bath for a few more seconds. The test-tube is now removed from the bath and rocked gently, at

short intervals, until the mixture is seen to coagulate. The time in seconds (accurately recorded with a stop watch) from the time of adding calcium to the moment of coagulation constitutes prothrombin time.

Whenever a new specimen of thrombokinase is prepared and whenever new solutions are made, the prothrombin time of normal controls is estimated for purposes of comparison.

Quick's method was slightly modified by Illingworth (1939). The general procedure is the same as above but the source and quantity of material used to prepare the emulsion of thrombokinase differ. Quick prepared the thrombokinase from rabbit's brain by macerating the brain with acetone, while Illingworth uses human brain tissue from the autopsy room. After removal of the meninges and vessels, the brain is thoroughly washed to remove all blood and is pulped and ground into a uniform paste. It is then spread as a thin layer over a sheet of glass and dried by an electric hot-air blower. The dried brain is scraped off and stored in a well-stoppered bottle. Before use, 2 grammes of the dried brain is emulsified in 10 c.cm. of physiological saline and incubated for 15 minutes at 37°C. After this, it is filtered through gauze to remove coarse fragments.

In our early studies, we followed Quick's original method; later, as acetone was not available locally, we followed Illingworth's modification.

#### *Prothrombin time in normal healthy adults*

In our observations on 20 adults, using Illingworth's technique, we obtained prothrombin times ranging between 15 and 25 seconds (see table). In an earlier series, where

TABLE I\*

*Prothrombin time with M/40 calcium chloride solution*

Number of cases	Nature of disease	Ages: years	PROTHROMBIN TIME IN SECONDS		
			Range	Mean	S. D.
20	Normals, and non-hepatic conditions.	15 to 40	14 to 25	19.2	± 2.8
	Jaundice	25	..	45.0	..

TABLE II\*

*Prothrombin time with M/10 calcium chloride solution*

Number of cases	Nature of disease	Ages: years	PROTHROMBIN TIME IN SECONDS		
			Range	Mean	S. D.
20	Normals or non-hepatic diseases.	15 to 55	41 to 65	53.1	± 7.6

\* Summarized by Editor.

thrombokinase from rabbit's brain was used, we noticed that the prothrombin times were two to three times longer than in Quick's experience. The prothrombin times of 24 adults with no recognizable disease of the liver or of blood were between 40 and 60 seconds (table II). This undue prolongation of clotting time, we later found to be due to the fact that the calcium solution used in this early series was made by dissolving 1.11 grammes in 100 c.cm. of distilled water as mentioned by Quick (1938). This figure is obviously a wrong one\*, as Quick and other workers, using the same method, mention repeatedly that a M/40 solution of calcium is to be used. Such a solution is prepared by dissolving 0.2775 gramme in 100 c.cm. of distilled water. Tests repeated with M/40 solution gave a prothrombin time of 15 to 25 seconds.

#### *Prothrombin in various clinical conditions*

With the kind co-operation of the staff of the King George Hospital, a number of patients from the out-patient as well as in-patient departments were examined for prothrombin time. Patients with skin diseases, patients with even surgical conditions (like carbuncle neck, iliac abscess, vesical calculus) or patients with medical complaints (like lumbago, lymphadenitis, peripheral neuritis, chronic arthritis and round worms) did not show any definite and significant alterations from the normal. The only cases which gave prolonged prothrombin time were those suffering either from severe jaundice or cirrhosis of the liver. One patient with jaundice has been diagnosed as cancer of the stomach with large multiple deposits in the liver. These cases came into the hospital in the early days of our observations when the normal adults gave a prothrombin time ranging between 40 to 60 seconds. Two patients with obstructive jaundice and two with cirrhosis of the liver gave prothrombin times ranging between  $2\frac{1}{2}$  minutes and 3 minutes (see table III). As far as we have been able to ascertain, none of these four patients had so far manifested any tendency to bleeding.

Determination of prothrombin time with the improved dilution technique, on similar cases and on other types of cases, is being continued. Further, work is also in progress to prepare a chart like that of Quick indicating the relation of clotting time to the concentration of prothrombin, with ultimate object of providing clinicians with a ready and convenient scale to estimate the risk of hæmorrhage in any patient.

\* In a private communication, Quick has pointed out that this was a printing error; 100 c.cm. should have read 400 c.cm.

[Note.—Napier and Das Gupta (*Indian Med. Gaz.*, 76, 229) copied this wrong figure into their paper, but these writers have actually been using a weaker solution of calcium chloride, and they now confirm the present writers' observation that more accurate results are obtained with M/40 solution.—EDITOR, I. M. G.]

TABLE III

*Prothrombin time in clinical conditions, with M/10 calcium chloride solution*

HEALTHY MEDICAL STUDENT SHOWED A PROTHROMBIN TIME OF 57 SECONDS			
Number	Age	Disease	Prothrombin time in seconds
1	25	Jaundice	165
2	40	Cirrhosis of the liver	169
3	50	Do.	150
4	35	Jaundice—cancer liver	140
5	40	Enteric fever 19th day (bloody motions on the 17th day).	85
6	30	Peripheral neuritis	52
7	50	Ing. hernia	50
8	30	Iliac abscess	75
9	22	Vesical calculus	67
10	57	Carbuncle neck	76

#### *Control.*

The last four were pre-operative cases.

#### *Summary*

1. Prothrombin time of a number of healthy adults was determined according to Quick's method. In the earlier series when M/10 calcium chloride solution was used the time ranged between 40 and 60 seconds. In the second series where M/40 calcium chloride was used the time ranged between 15 and 20 seconds.

2. Prothrombin time was markedly prolonged in cases of obstructive jaundice and cirrhosis of the liver. It was more than  $2\frac{1}{2}$  minutes when the normals gave a prothrombin time of 40 to 60 seconds, and 45 seconds when the controls gave a prothrombin time of 15 to 25 seconds.

3. The prothrombin time was normal in subjects with certain complaints (warts, gonorrhoea, lumbago, enlarged lymph glands and ophthalmic conditions).

4. Prothrombin time was slightly prolonged in a case of carbuncle, in iliac abscess, enteric fever, periostitis, secondary syphilis with rash, etc.

5. Recent improvements in the technique of the test, using serial dilutions, may bring out more definitely minor degrees of prothrombin deficiency in cases of malnutrition involving subclinical multiple vitamin deficiency, and in medical and surgical conditions, specially common in the tropics.

*Acknowledgments.*—We are greatly indebted to the members of the staff of the King George Hospital, Vizagapatam, for their co-operation in carrying out these investigations and to Mr. Krishnamurty, Lecturer in Chemistry, Andhra Medical College, for help in laboratory work. We are grateful to Dr. Alahasingari, Professor of Physiology, for his interest in the progress of this work and for some valuable suggestions.

Medical journals received in India during the last three months (and after the completion of this paper) contain many articles dealing with further work on the subject. Three important lines of development deserve to be specially noticed:—

1. Allen, Julian and Dragstedt (1940) advocate a modified one-stage technique using serial dilutions in the determination of prothrombin. The authors refer to the advantage of serial dilution in cases in which prothrombin response to vitamin K is minimal or sluggish. They conclude that the more dilute plasmas more readily reflect minor changes in the clotting time.

2. Souter and Kark (1940) prepared a stable thromboplastin by utilizing the method of 'lyophilization', thus avoiding the rather laborious and time-consuming processes involved according to Quick. The thromboplastic reagent for the test could be readily and easily obtained for immediate use by the addition of distilled water alone.

Fullerton (1940) dispenses with the elaborate method of preparing the thromboplastic substance from brain or other tissues and used Stypven solution (0.1 gm. of venom being dissolved in 1 c.cm. of distilled water). In working with serial dilutions, he noticed that the end point could be more easily determined when Stypven is used than with emulsions of tissue extracts. Hobson and Witts (1940) however point out, in a preliminary communication, that snake venom must be supplemented with lecithin, and promise a full account of their experiments in the near future. They employed Rusven (Boots).

3. Fitzgerald and Webster (1940) record their observations with a bed-side test. They prepare thromboplastin by Quick's method. 0.1 c.cm. of blood is placed in a small test-tube, the blood to be tested is added to make up 1 c.cm. Clotting time is noted and compared with the clotting time of normal blood. The authors recommend this test for ward work.

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## THE STERILITY AND POTENCY OF INJECTABLE SUBSTANCES

### (iii) CHOLERA VACCINES

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PASRICHA *et al.* (1938) recorded the results of the examination of fourteen cholera vaccines. The vaccines were tested for sterility, freedom from abnormal toxicity, antigenic response in rabbit and man, and protective value in guinea-pigs. It was found that whereas the six cholera vaccines prepared by recognized laboratories gave satisfactory antigenic response and protected guinea-pigs against two M.L.D. of *Vibrio cholerae*, only four of the eight commercial preparations produced cholera agglutinins and four vaccines gave uniformly negative results. It was further shown that the comparatively simple test of direct agglutination gave valuable information as to the antigenic structure of the organism used in the preparation of the vaccine, and that the results obtained by direct agglutination test corresponded closely to the results of the more costly and time-consuming agglutininogenic test in animals.

A further series of 200 samples of cholera vaccines have been tested with the following results:—

Number of vaccines that did not pass the sterility test—68 or 34 per cent.

Number of vaccines that were not satisfactory by the direct agglutination test—102 or 51 per cent.

Number of vaccines that passed both the sterility and potency tests—74 or 37 per cent.

The opacity of each vaccine was compared with Brown's opacity tubes and controlled with a vaccine made in the laboratory and stored for different periods so that the test vaccine was compared with a control vaccine of approximately the same age. The opacity of the different samples varied considerably; some were very thick suspensions (corresponding to about 16,000 millions per c.cm. or even more, to others which were so light that the opacity could not be estimated). All samples were claimed to contain 8,000 million organisms per c.cm. The final readings were made by comparing with Brown's opacity tubes 1 to 4, and, if the vaccine was more opaque than tube 4, the vaccine was diluted so that the diluted suspension came

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within the range of tubes 1 to 4. The strength of the original suspension was calculated by multiplying with the dilution factor. The results of the opacity tests are summarized below :—

TABLE

Showing the opacity of 200 samples of cholera vaccines

Opacity in millions per c.cm.	Number of samples	Percentage of samples
1,093 or less ..	24	12
2,185 ..	46	23
3,278 ..	48	24
4,370 ..	20	10
6,556 ..	14	7
8,740 ..	16	8
13,152 or more ..	32	16

Even after allowing for the autolysis which is known to occur, it is unlikely that the 70 samples of cholera vaccines which showed an opacity of 2,185 millions per c.cm. or less originally contained the 8,000 million organisms that they were claimed to contain. The finding of considerable excess of organisms in 32 (16 per cent) of the samples suggests that adequate control of the suspensions is not maintained during manufacture. This is a point that should be and can be easily controlled by the manufacturers of cholera vaccines.

In order to overcome the difficulty of autolysis that occurs in vaccines, a thick suspension of *V. cholerae* was desiccated and sealed under vacuum. The desiccated vaccine re-suspends readily in saline and there is no appreciable loss in opacity during storage. There is the additional advantage of considerable saving of space with desiccated vaccines, and, from the results obtained so far, there are indications that the vibrio antigens are better preserved in the desiccated state than in liquid suspensions, a conclusion which is supported by a considerable volume of published data on the preservation of other biological material. The method of desiccation is comparatively simple and offers great advantages, particularly in this country where there are great difficulties of adequate storage and transport.

#### Summary

The results of the examination (for sterility and potency) of a series of 200 cholera vaccines are recorded. Sixty-eight, or 34 per cent, did not pass the sterility test and 102, or 51 per cent, were not satisfactory by the direct agglutination test. Seventy-four, or 37 per cent, of the 200 samples passed both the sterility and potency tests.

The opacity of the cholera vaccines varied considerably; some suspensions were too thick, containing approximately twice the amount of organisms that they were said to contain, whilst others were so light that the opacity could not be

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## HYPOCHLORÆMIA IN CHOLERA

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THE rôle of deficiency of chloride in the blood as a factor leading to disturbances of renal function has been known for a long time. It has further been observed that hypochloræmia, whatever the cause, produces a train of manifestations more or less similar in all circumstances.

Porges described a syndrome in 1922 for which he subsequently (1932) gave the term 'coma hypochloræmicum' in which he found diminution of the chloride content of the blood with rise in the nitrogen of the blood. Since the publication of Porges, the condition has drawn the attention of workers all over the world and has come to be recognized universally. The French school under Blum and von Rathery studied this condition clinically and applied the term *azotémie per manque de sel*. These workers have been corroborated by others of the French school.

The American workers, Brown *et al.* (1923), studying the problem from a clinical point of view, and Haden and Orr (1923a), Whipple, Cook, and Stearns (1917), studying it experimentally, have confirmed the findings of Porges (*loc. cit.*).

A study of these papers shows that the hypochloræmic condition may appear in the following five groups of instances :—

1. Hypochloræmia appearing in conditions following persistent removal of the gastric contents by vomiting or loss of chloride by severe diarrhoea.

2. Hypochloræmia by transport and retention of chloride in the tissues.

3. Hypochloræmia due to deficient intake of NaCl.

4. Hypochloræmia due to removal of a big quantity of fluid with high NaCl content, *e.g.*, ascites, burns, etc.

5. Hypochloræmia in suprarenal insufficiency.

Of these five groups of conditions causing hypochloræmia the first group falls under the subject of our present study. Our present study

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determined. From the results of preliminary experiments it is suggested that desiccated vaccines sealed *in vacuo* retain their antigenic properties longer and that this method of preparation is readily applicable and offers many advantages over the usual method of preparation and distribution of cholera vaccines.

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goes a step further, as in cholera we find a combination of both the conditions comprising the first group, *i.e.*, a combination of persistent removal of NaCl of the gastric content by vomiting and loss of NaCl by severe diarrhoea.

In cases of excessive vomiting the removal of a large quantity of chlorides which are normally secreted into the stomach leads to a diminution in the level of the plasma chloride. This condition has been repeatedly observed in cases of vomiting due to gastric irritation, pylorospasm, pyloric obstruction, toxic states, *e.g.*, uræmia, toxæmia of pregnancy, etc. This is also true in cholera.

That it is not due to retention of chlorides is shown by the fact that the degree of hypochloræmia is dependent upon the quantity of chloride secreted into the stomach. This is exemplified in cases of carcinoma of the stomach or in achylia of pernicious anæmia, where excessive vomiting is associated with little or no hypochloræmia, as there is a condition of true achlorhydria existing in these conditions. It appears thus that the hypochloræmia in cholera is due to elimination of the chloride through vomiting and purging and not due to retention of chloride in the tissues. Our own observation shows a great loss of chlorides through vomiting in cholera.

TABLE I

*Showing the amount of vomitus during 24 hours and the sodium chloride content per 100 c.cm. of the vomitus*

Case number	Total volume of vomitus in c.cm.	NaCl content mg. per 100 c.cm. of the substance
1	3,500	221
2	2,500	262
3	4,800	455
4	2,500	233

This shows an average of 3,325 c.cm. of vomitus containing 293 mg. of NaCl per 100 c.cm. of the substance. Thus the total excretion of NaCl through vomiting during 24 hours had been more than 9.7 grammes in an average case of cholera. Thus, it is seen that a great loss of chloride from the stomach takes place through vomiting.

Normally, most of the chloride secreted into the gastro-intestinal tract is re-absorbed from the intestines into the circulation. Our material shows that in every case of cholera with large quantity of fluid evacuations a considerable amount of chloride is lost through this channel.

From this we find, in cases of ordinary severity, the maximum figure of 865 mg. per 100 c.cm. of stools. The total quantity of stools was 4,000 c.cm., that means, there had been a loss of 34.6 grammes of chloride during 24 hours by the bowel.

TABLE II <sup>c</sup>

*Showing the total volume of stools (in c.cm.) passed during successive periods of 24 hours, along with the sodium chloride (mg.) per 100 c.cm. of the stool and blood during the same period*

Case number	Total volume of stool in 24 hours (in c.cm.)	SODIUM CHLORIDE CONTENT (MG.) PER 100 C.C.M. OF THE SUBSTANCE DURING 24 HOURS	
		Stool	Blood
1	500	473	390
	1,500	227	350
	1,200	180	450
	1,000	113	450
2	1,000	332	465
	1,700	238	470
	600	262	460
3	600	590	457
	1,500	677	440
	700	174	390
	1,000	309	390
4	3,500	408	340
	1,500	212	415
	700	204	425
5	600	753	490
6	1,500	531	445
	1,700	555	480
	1,000	338	490
7	2,000	484	480
	2,000	403	485
	500	473	475
8	1,700	332	450
	1,000	379	440
9	1,500	531	490
	500	408	420
10	1,000	239	495
11	4,000	865	390
	3,000	408	390
	1,000	297	450
	600	262	435
12	2,000	578	450
	700	325	440
	1,000	262	470
	500	215	450
13	3,000	438	430
	3,500	315	360
	4,500	280	365
	2,500	145	360
14	1,500	508	425
	2,500	625	440
	2,580	555	420
	1,800	637	395
15	5,000	637	445
	2,600	578	450
	3,500	344	430
	1,000	403	435
	2,500	321	475
	700	303	485

TABLE II—*concl'd.*

Case number	Total volume of stool in 24 hours (in c.cm.)	SODIUM CHLORIDE CONTENT (MG.) PER 100 C.C.M. OF THE SUBSTANCE DURING 24 HOURS	
		Stool	Blood
16	3,600	590	475
	2,000	683	470
	2,400	520	457
	500	361	450
17	1,300	601	462
	2,000	449	475
	500	385	470
18	500	110	492
	3,000	385	487
	500	321	415
	700	449	455
19	2,000	438	420
	1,000	391	465
	1,500	414	487
	1,000	227	450
	1,000	379	435
20	3,500	859	410

The loss of considerable quantities of NaCl through vomiting and purging leads to a condition of hypochloræmia and as a result the elimination of chloride in the urine is also greatly diminished. Table II shows the amount of chloride in the blood observed from day to day. It must be noted in this connection that these cases received a fair quantity of fluids containing on an average about 25 grammes of NaCl in the form of intravenous and subcutaneous injections daily during the first 2 or 3 days. It is seen that in spite of this considerable quantity of NaCl administered intravenously or subcutaneously the blood chloride never rose above 495 mg. per 100 c.cm. of blood. In quite a large number of cases it remained at 350 mg. to 450 mg. level. The samples of blood taken before intravenous injections of saline gave a much lower figure. This shows that, in cholera, hypochloræmia is invariably present in all cases.

As a 'threshold substance', NaCl with a threshold value of 560 mg. to 570 mg. per 100 c.cm. of blood is re-absorbed through the tubules back to the circulation in order to maintain its equilibrium in the blood. In cholera, as the plasma chloride concentration is lowered to the limit of the threshold value, a decrease in the urinary chloride occurs and this may sometimes be very low or totally lacking. The diminution in the plasma chloride concentration produces a great alteration in the distribution of electrolytes and in the acid-base balance. This constitutes one of the most significant metabolic features in conditions producing hypochloræmia, and particularly in cholera.

A study of the literature shows that in 1849 Parkes (Rogers, 1911) found in cholera stools  $\frac{1}{2}$  to 1 per cent of salts and in 1850 Schmidt (Peters and Van Slyke, 1931) pointed out the extreme dehydration and loss of chloride in cholera. Rogers (1911, 1921) found an average of 0.53 per cent of chlorides, i.e., loss of half an ounce of chloride in every 100 oz. of stools. He is of the opinion that in most severe cases over two-thirds of the salts of the blood may have been lost from the circulation and presumably almost as great a proportion from the whole system.

#### *Rôle of hypochloræmia in the production of azotæmia*

Banerjee (1931) has pointed out that there is great retention of nitrogenous waste products in the blood in almost every case of cholera. This azotæmia often becomes extreme but it shows lowering as soon as the urine flow is re-established. Banerjee and Datta (1935) have further called attention to the fact that a high non-protein nitrogen, or urea retention, does not necessarily mean a bad prognosis. This shows that the azotæmia in cholera is of extrarenal origin. It shows further that there exists a close relation between hæmoconcentration and hypochloræmia, and nitrogenous retention. There has been a great deal of controversy regarding which factor, hæmoconcentration or the hypochloræmia, is of more importance in the production of azotæmia. Banerjee (1939) has shown that hypochloræmia is of more importance as introduction of a fairly big quantity of fluid in the form of glucose produces little change in azotæmia, while a small quantity of hypertonic NaCl solution improves both hypochloræmia and azotæmia.

#### *Factors for the production of hypochloræmia*

It is the general opinion that the fall of blood chlorides in cases of vomiting is mainly due to loss of chlorides from the stomach. This has been observed repeatedly by animal experiments. In animals, e.g., rabbits, which are unable to vomit, Gamble and McIver (1925) found in the stomach sufficient salt, hydrochloric acid and water to account for the loss of blood chloride. These animals generally recover if the obstruction is relieved within 15 hours, but not so if the stomach contents are previously removed and replaced by water, before relieving the obstruction. Further, other workers, notably Foster and Hausler (1925), Foster (1928), and Gatch, Trusler and Ayers (1927) have shown that death never takes place of toxæmia or hypochloræmia, but of inanition if sufficient NaCl is administered parenterally. That toxæmia can be a factor in the fall of blood chloride is shown by the experiments on monkeys by Haden and Orr (1925) when they observed that there had been no vomiting in the animals with experimental intestinal obstruction, which

showed the characteristic fall of blood chloride. All animals showed the marked rise in non-protein nitrogen. Coincident with the change in chlorides there had been a rise in the  $\text{CO}_2$  combining power. Haden and Orr (1923a) believe that a fall in chlorides is the first and seemingly most significant change to take place in the blood after pyloric and intestinal obstruction. The chloride is apparently utilized by the body as a protective measure against the primary toxic substance. This is shown by the fact that the life of the animals is prolonged when NaCl is given subcutaneously daily, while a like amount of distilled water, or 25 per cent glucose showed the changes typical of untreated animals. They have found that solutions of NaCl have a marked effect in preventing and controlling the toxæmia of pyloric and intestinal obstruction as shown in clinical symptoms and in chemical changes in the blood. Solutions of glucose have no specific value and sodium bicarbonate solution prolongs life only for a short while. They (1923b) believe that the chloride is probably bound somewhere in the process of protein destruction.

The great loss of chloride in cholera might be explained by the action of some poisoning of the vascular membrane leading to increased permeation through the capillaries or by some physiochemical change in the blood leading to the loss of NaCl directly into the tissues, or body cavities. Haden and Orr (1923) drew attention to the similarity of the blood findings in intestinal obstruction, acute lobar pneumonia, and serum disease suggesting that these widely different conditions may have a common chemical basis. It appears to us that cholera can also be included in this list.

The kidney plays a great rôle in regulating the chloride balance in the body, more particularly in cholera when the function of the kidney is greatly altered. Hypochloræmia is due to the tendency of the kidneys to excrete chloride in the urine even when the chloride concentration in the serum has fallen far below the threshold level. It appears that the function of conserving the salt supply is lost.

#### *Hypochloræmia and acidosis*

Chlorides play a great part in stabilizing the acid-base balance of the body fluids by helping the interchange of buffer effects between the richly buffered cells and the poorly buffered plasma. In cholera, the acid-base balance is greatly altered (Banerjee, 1936) and so is the quantity of the chlorides. This shows that deficiency of the chloride anions in plasma interferes with the exchange of the bicarbonate anions from cells to plasma.

A vicious cycle thus occurs in cases of cholera as a result of the intimate relations which exist between the loss of chloride and the maintenance of the acid-base balance. If the base and

chloride loss remains unrestricted, it leads to but one result and that in the form of depletion of the salt supplies of the body as a whole which is invariably followed by loss of water, dehydration, retention of nitrogenous waste products and renal failure.

From the point of view of the presence of considerable hypochloræmia in every case of cholera, an attempt has been made to increase the strength of NaCl in the fluid now used for intravenous injections. As a 10 per cent NaCl solution often causes great discomfort to the patient a 5 per cent NaCl solution is used with favourable results. As this is in an experimental stage no detail need be given now.

#### *Summary*

It is pointed out that hypochloræmia occurs in various widely different conditions, particularly in those in which vomiting and purging occurs, and more particularly in cholera.

From our own material a great loss of chlorides is found to occur in every case of cholera through vomiting and purging even after replacement of NaCl and fluids by adequate quantity of hypertonic saline.

Attention is drawn to the effect of hypochloræmia in the distribution of electrolytes and that of the acid-base balance in cholera.

The rôle of hypochloræmia in the production of azotæmia, uræmia and renal failure in cholera is shown to be of great importance.

My thanks are due to Prof. C. C. Basu for his helpful interest, to the physicians in charge of the Isolation Hospital for permission to utilize the material, to the house physicians for their co-operation, and to Mr. A. K. Chakrabartty for technical assistance in the work.

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## ERYTHROPOIETIC FACTOR IN HUMAN MIXED SALIVA

By A. SITARAMAMURTI, M.B., B.S.

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It is an old saying that the habit of constant spitting has debilitating effects on the individual. On going through the literature on the effects of saliva, it was found that recently Tempka (1937) recorded erythropoietic effect of human saliva. He fed 20 litres of saliva to a patient with pernicious anaemia in relapse and observed a reticulocytic response and symptomatic improvement on the sixth day of the treatment; he considered that these hæmatological changes were not the result of spontaneous remission but were due to the beneficial effects of saliva. This investigation of mine was undertaken with the hope of throwing more light on the subject.

*Method*

The mixed human saliva was collected in a flask and it was detoxicated according to Duyvensz (1934) by mixing well with three times its quantity of ether. This was found to be quite unnecessary and so in the later experiments fresh human mixed saliva, soon after it was collected, was directly injected intramuscularly into pigeons without any detoxication or sterilization.

Muller (1932) was of opinion that pigeons were peculiarly sensitive to hæmopoietic factor which causes striking reticulocyte response and therefore pigeons were selected as experimental animals in this investigation. All the pigeons were allowed to become stabilized as to their weight and reticulocyte percentage before the commencement of the injections of saliva. This usually occupied about a week and during this time frequent examinations of peripheral blood and bone-marrow were made.

*Injections of saliva.*—When the pigeons were thus stabilized they were given 3 c.cm. of fresh human mixed saliva intramuscularly twice a day for three days continuously. Microscopic examinations of the peripheral blood and bone-marrow were carried out daily. A drop of blood for this purpose was obtained by puncturing a vein in the wing and the bone-marrow by aspirating the shaft of the femur.

*Staining.*—The blood drop and the bone-marrow thus obtained were added separately

to 1 c.cm. of brilliant cresyl blue solution in separate test-tubes. The contents were thoroughly mixed up immediately and also at intervals of five minutes for about half an hour. The cells were allowed to settle down.

The brilliant cresyl blue solution was prepared as follows:—

(a) 1 per cent brilliant cresyl blue in 0.9 per cent saline.

(b) 1 per cent sodium oxalate in 0.9 per cent saline. Just before use, (a) and (b) solutions were mixed in the proportion of two of (a) and one of (b).

*Reticulocyte counts.*—Counts were made in at least a total of 500 red blood cells almost daily throughout the period of experimentation.

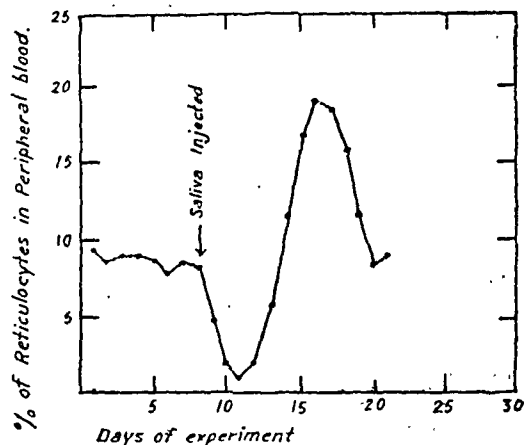


Figure showing reticulocyte response

Weight of the pigeon 274 grammes.

After the period of stabilization for one week, 3 c.cm. of fresh human mixed saliva was injected intramuscularly on the 8th, 9th and the 10th day. The fall in the reticulocyte count noticed soon after the first injection continues till about 24 hours after the last injection. This is followed by a gradual increase in the reticulocyte count day by day. The maximum count is reached by about the 6th day after the last injection.

The slides were prepared in two ways. After the cells settled down in the test-tubes, (1) films were made on clean slides by the usual technique and were lightly counterstained with Leishman's stain. These slides were then examined under the oil-immersion lens; (2) a coverslip preparation of a drop of each of the specimens was directly examined under the oil-immersion lens. By this method the reticulocytes could be more easily recognized as compared to the former method.

*Results*

Before the course of injections of saliva, the reticulocyte count was at about 8 to 9.5 per cent in the peripheral blood and 1 to 1.5 per cent in the bone-marrow on the average. After the injections the reticulocyte count fell to 3.5 to 4 per cent and seven to eight days after the last injection, the reticulocyte count reached a maximum of 17 to 19 per cent in the peripheral blood.

A similar rise in the reticulocyte count from 1 to 4 per cent was also observed in the bone-marrow. The pigeons apparently maintained their normal health. Further changes in the

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bone-marrow smears were noted before and after the injections.

The normal bone-marrow consisted of a large number of fat vacuoles and scanty cellular element. The cells were mostly megaloblasts with few normoblasts, erythroblasts, and erythrocytes. After the course of injections, the fatty nature of the bone-marrow has almost disappeared due to the increased formation of new erythrocytic centres. The cells were found to be mainly normoblasts with a few megaloblasts and erythrocytes.

### Discussion

The results described show a fall in the reticulocyte count soon after the injections and then a gradual increase reaching its maximum by about the fifth to the sixth day. The initial fall in the count may be due to a factor in the saliva which hastens the maturation of most of the reticulocytes. The same factor or some other factor may stimulate the bone-marrow, resulting in the maximal production of reticulocytes. Castle and his co-workers demonstrated that the intrinsic factor is present only in gastric mucosa and not in saliva. The reticulocyte response and the symptomatic improvement noticed by Tempka in patients with pernicious anaemia after the oral administration of large quantities of saliva is suggestive of the presence of some hæmopoietic factor in saliva. The results obtained are in close agreement with Tempka. The marked reticulocyte-count increase in the peripheral blood, the increase in the erythrocytic centres in the bone-marrow and the greater preponderance of normoblasts over the megaloblasts after a course of injections are all

suggestive of the presence of a hæmopoietic factor in human mixed saliva.

This investigation was carried out in the Central Institute of Physiology, Medical College, Madras. I am grateful to Dr. M. A. Basir for suggesting the subject and also for the guidance throughout the investigation. My grateful thanks are also due to Dr. B. T. Krishnan for his helpful suggestions and kind permission to submit this paper for publication.

### Summary

1. After stabilizing pigeons as to their weight and reticulocyte count, they were given a course of six injections of fresh human mixed saliva intramuscularly.

2. After the injections, the reticulocyte count in the peripheral blood had increased from about 8 to 18 per cent.

3. There was an increase in the hæmogenetic centres in the bone-marrow of the femur after the injections.

4. The great increase in the normoblasts of the bone-marrow was also noticed after the injections.

5. These are suggestive of the presence of a hæmopoietic factor in the human mixed saliva.

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[Note.—Muller's observations on the specific response of pigeons to the hæmopoietic factor have not been confirmed. The experiment reported above is entirely uncontrolled and the fact that fresh saliva was used seems to lay the experiment open to grave criticism. Nevertheless, we consider that the findings are interesting enough to be reported briefly.—Editor, *I. M. G.*]

## A Mirror of Hospital Practice

### INDUCED MALARIA WITH HEAVY MALIGNANT TERTIAN INFECTION

By SIR R. N. CHOPRA, *Kt.*, C.I.E., M.A., M.D.,  
 S.C.D. (Cantab.), F.R.C.P. (Lond.)  
 BREVET-COLONEL, I.M.S. (Retd.)  
 B. SEN, B.Sc., M.B. (Cal.)

and

J. C. GUPTA, M.B. (Cal.)

(From the School of Tropical Medicine, Calcutta)

RAM LAL, a Hindu male, 45 years old, was admitted into the Carmichael Hospital for Tropical Diseases on 27th February, 1941, for malaria therapy. His lower extremities showed signs of great weakness. Examination of blood showed a moderately positive Wassermann reaction. Physical examination revealed the following findings:—Tongue coated; lungs moist and dry sounds all over both lungs; liver slightly enlarged; spleen not palpable; heart nothing abnormal noted; bowels loaded; lower extremities, signs of great weakness in both.

Knee jerk absent on the right and somewhat brisk on the left. Pupils eccentric but react to light and accommodation; gait, tabetic; ankle jerk, absent. The patient was suffering from tabes dorsalis and malaria therapy was advised.

The patient was injected on 28th February with 10 c.cm. of blood showing a scanty infection of benign and malignant tertian parasites, but there was no sign of fever for three weeks. On 23rd March he was given an injection of adrenalin chloride but this also failed to bring about any pyrexia. On 27th March he was re-inoculated with 10 c.cm. of blood showing a moderate infection of *Plasmodium falciparum*. On 29th the patient first showed signs of a rise of temperature but an examination of the blood showed no malaria parasites. The temperature, however, persisted in an intermittent form and on 3rd April, examination of blood revealed the presence of scanty malignant tertian rings. This intermittent temperature persisted more or less daily and the blood also showed scanty malignant tertian rings until 9th April on which day a moderate infection was noticed in the blood (roughly one ring in alternate fields). Spleen was found to be slightly enlarged. The intensity of infection remained like this until 10th April but on 11th we found that



between 30 and 40 per cent of the red cells in a field were infected with rings.

The physical examination at this stage revealed the following:—Pulse—soft, 140 per minute; respiration—40 per minute; lungs—rough, dry and moist sounds all over, especially marked on the right side. The patient was having great difficulty in breathing. Heart sounds very feeble; abdomen slightly distended; spleen—palpable; temperature—104°F. Patient was quite conscious but very restless.

The patient was given  $7\frac{1}{2}$  grains of quinine bi-hydrochloride dissolved in about 20 c.cm. of water by the intravenous route, injection being given very very slowly. One hour after the injection examination of blood smears showed only 2 or 3 rings per field, but the general condition of the patient still caused anxiety. The pulse was small and rapid and there was a considerable amount of respiratory distress. The patient, from the beginning, was put on rum, 2 drachms every two hours and glucose by mouth; injections of cardiazol, and strychnine-digitaline were also given. He was given oxygen and an injection of atropine was also given for the respiratory difficulty.

Examination of blood smears every hour showed a gradual increase in the number of parasites and five hours after the injection of quinine 4 or 5 rings were noticed per field. Quinine bi-hydrochloride ( $7\frac{1}{2}$  grains) was given by the intramuscular route. The condition of the pulse appeared to improve and the temperature came down to 99.6°F., the patient perspiring profusely. Oxygen, glucose and rum were continued.

On 12th April the condition of the patient was slightly better, temperature went up to 101°F. and blood smears showed 5 or 6 rings per field. The patient was put on quinine sulphate, 5 grains three times a day by mouth. The temperature persisted throughout the whole day and night. The highest temperature on the 13th was 102.6°F., blood smears showing 2 or 3 rings per field with very scanty crescents. The condition of the lungs was much better and the respiratory distress was much less. The pulse and respiration ratio varied from 120/40 to 140/36.

On 14th April the temperature came down to 99°F. and blood was showing scanty rings and a fair number of crescents. There was considerable improvement in general condition, pulse had good volume and there was practically no respiratory distress.

On 15th April temperature came down to 98°F., pulse attained normal tension and examination of blood showed very scanty rings and a large number of crescents. The administration of quinine by mouth was stopped, the patient having had 9 doses in all (45 grains).

On 16th April the temperature was normal and the general condition was much improved. Blood smears showed rings in thick film only and a large number of crescents were observed.

On 17th April temperature was subnormal. Blood showed fair number of crescents but no rings were detected in thick and thin films. The patient's condition was quite normal.

### Discussion

The senior author (Chopra, 1936) has been using artificial infection with malaria in the treatment of neuro-syphilis for many years with beneficial results. In temperate climates the method of choice is to transmit the disease by infected mosquitoes. In India, however, cases of malaria are always available and injection of infected blood is more convenient. Further in non-malarial countries *Plasmodium vivax* is always used for malaria therapy, but our experience in India is that it is not always possible to induce infection with this species, probably on account of the immunity which a large number of people have against this parasite, because of the frequency of its occurrence. The senior

author has, therefore, often used blood infected with *P. falciparum* with which infection is more readily established, the patient being kept under careful observation all the time by examination of blood once or twice daily, as soon as the infection is established.

So far no untoward results have been observed and 8 to 10 paroxysms of fever could be given without any difficulty and danger to the patient. In this patient two injections of infected blood had to be given and it is possible that the extraordinarily heavy infection which suddenly developed was due to the summation of effects of the two injections. It will be observed that after this first injection there was an appreciably long incubation period and it is likely that the second injection served the purpose of exciting the previous one, as well as producing its own effects.

The second point of interest in this case is the ready way in which infection produced by direct inoculation of blood is controlled by quinine. Here  $7\frac{1}{2}$  grains of quinine intravenously brought the number of parasites from 30 to 40 per field to 2 or 3 per field in one hour. The effect of a single intravenous injection, however, lasts for a short time on account of rapid excretion of the drug. Hourly examination of the blood films in this patient showed an appreciable increase in the number of parasites per field within five hours and an intramuscular injection of seven and a half grains of quinine, and later quinine by the mouth had to be given.

The increased vulnerability of parasites given by direct inoculation of blood compared with natural infection by mosquito bites was also demonstrated in this case. Chopra and Das Gupta (1936) showed a definite increase in the number of parasites in natural infection with *P. falciparum* after an intravenous injection of quinine. In this case there was not only no increase but in one hour the parasites were reduced from 30 to 40 per field to 2 or 3 per field.

In our cases of induced malaria in the Carmichael Hospital for Tropical Diseases in case of *P. vivax* infection by direct inoculation of blood, five grains of quinine usually suffice to get the infection under control, but in *P. falciparum* much larger quantities have to be used.

The last point is the peculiar rough, moist and dry sounds which were heard in the lungs during the height of infection. Were these adventitious sounds due to accumulation of parasites in the lung capillaries, or were these severally the result of very laboured respirations? As these disappeared as the number of parasites decreased it is possible that parasites had something to do with it.

This case should serve as a warning to those using malaria therapy in this country by direct inoculation of blood. It is not uncommon to get mixed infections and in spite of all precautions *P. falciparum* may be grown with *P. vivax* and may suddenly flare up.

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## INTERSTITIAL KERATITIS DUE TO FOCAL SEPSIS

By E. J. SOMERSET, M.S. (Lond.), D.O.M.S.  
and

F. H. R. DAVEY, L.D.S., R.C.S. (Eng.)

THE majority of cases of diffuse interstitial keratitis occur in congenital syphilis. Other but rare causes are acquired syphilis, tuberculosis, trypanosomiasis and leprosy. A unilateral post-influenzal parenchymatous keratitis has been recorded by Doggart (1931). Duke-Elder (1938), in an extensive review of the literature, makes no references to focal sepsis as a primary factor in the aetiology, but the following case seems to indicate that focal sepsis may be a rare cause.

**History.**—Anglo-Indian, male, aged 29 years, telegraphist. According to the patient, in the winter of 1936-37, he suffered from an attack of epiphora, photophobia and dimness of vision in the left eye which responded to treatment in about two months. He states that he had no further trouble until October 1939 when one eye, and soon after the other, became inflamed, causing him an intense epiphora and photophobia. Atropine and hot bathing gave little relief and for eight months he was only able to work occasionally. His general health had otherwise been good; he had malaria two years ago for which he had been given a full course of quinine and plasmochin. No history of allergic disease in either the patient or his family could be elicited.

**Examination.**—The writer (E. J. S.) first saw him in May 1940 and he presented the following picture:—

Right vision 3/60. Left vision. Counts fingers at 2 feet. Photophobia was so great that he could not tolerate the light of an indoor room and kept the eyes covered with a bandage. Epiphora was intense and was one of the main features of the case, being so marked that on raising either upper lid tears actually poured out. Both corneae showed signs of inflammation, characterized by a diffuse grey haziness, denser in some areas than in others, but involving the whole of the interstitial tissue. There was no deep vascularization perceptible to examination with a loupe. The surface of the corneae appeared normal and there was no staining with fluorescein or any superficial vascularization. There were no signs of trachoma. Tension was normal. Corneal microscopy was not available but with the loupe the inflammatory process appeared to be confined to the interstitial tissue. There was no K. P. but a moderate amount of ciliary and conjunctival congestion were apparent. There was no discharge on bandaging the eyes for twenty-four hours.

On 21st May he was admitted into hospital for investigation, he was kept in bed and atropine drops and hot fomentations were given. This treatment had little effect upon the disease process. The Wassermann and Kohn reactions were negative. Ears, nose and throat were reported normal. Physical examination revealed no other abnormality. X-ray of the chest was normal.

Dental report (F. H. R. D.) was as follows:—

'Superficially the mouth appeared to be clean. A small amount of tartar was removed from the lingual aspect of the lower incisors. 62/ and 456 were very loose and pus could be expressed from the gingival margins of these teeth. 76/ were slightly loose. X-ray

of the loose teeth showed rarefaction areas around the roots especially marked in the region of 2/. It was considered that these teeth might be subscribing to the eye condition and their extraction was recommended. Extractions were completed under Evipan anaesthesia on 10th June. Sockets were curetted and healing was uneventful.

Following dental operation, a dramatic change took place in the eye condition. In a few days the epiphora had almost ceased and at the end of a week the photophobia had disappeared. On 21st June the ciliary congestion was no longer present. In view of the immediate improvement following the extractions a further critical examination of the mouth condition was made. It was considered that 5/46 were very slightly loose and x-ray showed a small degree of apical absorption. These teeth were therefore extracted under nitrous oxide anaesthesia on 28th June and the patient left hospital on 2nd July with 6/15 vision in each eye.

**Progress.**—The corneae continued to clear and by 10th September, three months after operation, there were no corneal opacities visible to examination with the loupe and the vision was 6/6 in each eye. There has been no further trouble to date (March 1941).

**Discussion.**—It is just possible that the dental extractions coincided with a spontaneous remission of the disease, but in view of the long history, the lack of response to atropine and hot bathing, and the dramatic response to dental extraction, it would appear that the dental sepsis in this case was the cause of the interstitial keratitis.

**Summary.**—A case of interstitial keratitis due to dental sepsis is recorded. Intense epiphora was a marked feature of the case.

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## A RARE CASE OF DERMATALGIA

By P. L. DESHMUKH, M.D., D.T.M. & H.

Honorary Assistant Physician, Sassoon Hospitals, Poona

THE following case may be of interest owing to the rarity of the condition and the dramatic improvement in the state of the patient:—

A farmer, aged 28, was admitted into the Sassoon Hospitals, Poona, on 15th February, 1941, for severe burning sensation in the feet of 2½ months' duration. He was brought to the out-patients' department on a stretcher as he would not put his feet to the ground for fear of the burning sensation that would be increased thereby. He was admitted as a case of some disturbance of the sympathetic nervous system. On admission, it was found that he had severe burning sensation in both his feet, particularly in the soles, so intense that he could not bear even contact with light clothing. The complaint started suddenly, without any obvious cause about 2½ months back, and is continuing with the same intensity. He was treated in an ayurvedic hospital without any relief, for about a month. On examination, it was found that there was no change in the colour of the skin nor in the temperature of the affected part compared with the rest of the body. His hands were cold and clammy and he wore gloves to keep them warm. There was no history of alcohol, syphilis or leprosy in the family. There was no history of any change in the environment to precipitate this trouble. He had malarial fever for about a week 1½ years back. There was no objective evidence of disturbance of his nervous or other systems. Lumbar

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puncture was not found to be necessary. Results of the other investigations were as follows:—

Urine: nothing abnormal was detected.

Blood pressure: systolic 125 mm. Hg., and diastolic 80 mm. Hg.

Nasal smears before and after a strong dose of potassium iodide: negative for Hansen's bacillus.

Blood smear: nothing abnormal detected.

Wassermann reaction of blood: negative.

The following clinical conditions were looked for and excluded:—

*Peripheral neuritis.*—There was no tingling or numbness. Calves were not painful. All tendon-jerks were normal.

*Diabetes mellitus.*—Urine never showed any sugar. There were no symptoms of the condition. Blood sugar of a fasting sample was 80 mg. per 100 c.cm.

*Gonorrhœa.*—No history, and no evidence on examination.

*Leprosy.*—Nasal smears were negative repeatedly for Hansen's bacillus. There was no hyperæsthetic, anæsthetic or depigmented patches on the body. No thickening of nerves was noticed.

*Tabes dorsalis and subacute combined degeneration.*—There was lack of any evidence on examination of nervous system.

*Erythromelalgia, Raynaud's disease, endarteritis obliterans.*—Absence of trophic changes. No change in the colour and temperature of the skin. Pulsation of vessels was normal.

*Neurasthenia.*—The patient was in real distress and woke up even from deep sleep when his feet were handled.

*Pellagra.*—No evidence of pigmentation, dermatitis or other symptoms.

*Treatment.*—In the absence of any definite diagnosis, it was decided to put the patient on intensive vitamin therapy on the evidence that he showed a little congestion of his gums and some dryness of the skin. He was given a diet rich in vitamins, supplemented by adexolin, and intravenous injections of vitamins B and C. Lead lotion compresses were given to his feet which were protected by a cradle. He also required repeated and strong hypnotics in the beginning to bring on sleep, which was greatly disturbed by the burning sensation.

He was re-examined after about ten days of treatment, and though the patient complained that he had only little and temporary relief by treatment, it was observed that his trouble was definitely much less. It was noticed during examination that, though the patient felt the agony of touch by the examining hand, he did not feel anything when he was engaged in conversation or was kept busy otherwise. This observation led to the possibility of a neurosis, or a touch-phobia appearing on the top of his original trouble. To assess the part played by neurosis in the remaining trouble, the patient was ordered to walk in spite of his complaint. On his refusing to do so, he was taken out of his bed and forced to walk along the floor for a few feet with the help of two persons. As he gained confidence, he was gradually left to himself and it was found that he could walk alone briskly in the ward and along the corridor, the same day. From that moment his symptoms greatly ameliorated, appearing only in the early morning at about 4 a.m. for an hour or two. His remaining symptoms disappeared completely on the same line of treatment during the next week and he was able to run about like a normal man before his discharge. Though we believed that his improvement was due to intensive vitamin therapy, he used to say that it was due to the 'German hikmat' (trick) of forced walking.

*Discussion.*—The complaint of the patient was very peculiar and no reference to such a condition could be obtained in any of the usual text- or reference books on medicine. As the patient was about to be discharged, I came across an answer to a query about a similar case in the

*Journal of the American Medical Association* of 28th September, 1940, page 1120, where such a condition was diagnosed as dermatalgia. I extract below a few lines for the information of readers:—

'... there is no change in the appearance of the skin during attacks, thus justifying the diagnosis of dermatalgia, a disturbance of the nerves supplying the skin of the part affected, supposedly the nerves of the vegetative system. The pain varies in different cases, burning as in the case cited, or a sensation of hot or cold water running over the skin, of stabbing, cutting, rubbing of the skin, or the sensation of an electric current. The attacks come usually at night, affect middle aged women most often and are commonly associated with hyperæsthesia so that the contact of clothing or other objects adds to the distress. Hairy parts or the extremities are most often involved. . . . As possible ætiological factors, tabes dorsalis, malaria, rheumatism, diabetes mellitus, leucæmia and other members of the lymphoblastoma group and leprosy were mentioned. In addition chlorosis, hysteria and any cause of neuritis are mentioned in the literature. Exposure to cold is also mentioned, probably the reason for the mention of rheumatism. It might be well to examine for anæmia and the possibility of certain forms of avitaminosis, especially those in which elements of the vitamin B complex are concerned. . . . In the considerable proportion of the cases in which no such basis can be found, acetyl-salicylic acid, salicin, quinine and arsenic are recommended and the local use of alternating hot and cold applications, galvanic or faradic electricity or counter irritation over the nerves supplying the part. Langeron and Desplats are quoted as having suggested roentgen therapy over the sympathetic centres for the relief of the pain of dermatalgia. . . . A small dose of roentgen rays, from 40 to 80 roentgens filtered through 2 mm. of aluminum, may be effective. This can be repeated at weekly intervals. . . . The skin should be protected as far as possible from the irritation of clothing.'

It will be realized that the case had improved as a result of our investigation and treatment before we came across the reference quoted above.

The interest of the case lies in the following:—

(1) The case presents a rare condition known as dermatalgia.

(2) The disease occurred in a middle aged man, while it is believed to be more common in females.

(3) The condition was amenable to intensive vitamin therapy.

(4) The case well exemplifies the necessity of recognizing the fact that neurosis or a phobia may in the course of time supervene on a real complaint. Later, the complaint may gradually disappear and neurosis take its place, the latter requiring treating with a firm hand.

I wish to thank Dr. M. S. H. Mody, honorary physician, for helping me in the investigation of the case and Major H. S. Waters, I.M.S., for giving me permission to report it.

## A CASE OF ABDOMINAL PREGNANCY AND DELIVERY PER RECTUM

By K. M. NAYAK, L.M. & S.

Medical Officer, Government Hospital, Kasaragod

A WOMAN, aged about 30 years, wife of a forester, was admitted into the Queen Alexandra Hospital for

women in Salem town in the month of September 1932. She was said to have been pregnant for 18 months and was admitted for colicky pains which were mistaken for labour pains.

On examination, the abdomen was found to be of the size of a full-term pregnant woman. It was tympanitic all over. A round globular swelling was present in the middle line of the lower abdomen and extending up to 3 inches above the umbilicus. She had no difficulty in passing urine or stools. Frequency of micturition was a very distressing symptom. She had colicky pain with passage of blood and mucus simulating dysentery. One early morning, two days after admission, while she was passing a stool a small hand appeared at the anus; this frightened her. While examining the patient I pulled out the protruding hand and the whole of the right forearm from the elbow downwards came out easily. I had the patient taken to the Headquarters Hospital and put her on the table and examined her under chloroform. On rectal examination I felt the head 3 inches from the anus and also the stump of the remaining portion of the right arm. On pulling this down by gentle traction, the whole macerated foetus aged about six months came out followed by the placenta, all in one mass. The woman was in the hospital for eight days. Her recovery was uneventful.

I met her again in February 1939 after seven years. She was hale and hearty. She had had no more pregnancies.

Evidently this was a case of tubal rupture into the peritoneum. It could not be verified as no abdominal section was done. Her history was that she had some sort of pain about a year prior to her admission in the hospital and was treated at home by a quack.

The rupture must have taken place at six months, and the foetus was extruded into the peritoneum. Nature came to her rescue. Adhesions were formed around the foetus enclosing it in a sac and it remained there for a year after rupture. Latterly, the foetus ulcerated through the wall of the rectum and came out.

## A CASE OF ECLAMPSIA\*

By JIWANLATA

Medical Superintendent, Lady Butler Hospital,  
Khandwa

A HINDU FEMALE, aged 17 years, primipara, was admitted on the 4th November, 1940, with a history of fever and rigors for 3 to 4 days and fits since the morning.

*Family history.*—She was a pampered child of the family; her mother had hysterical fits during one of her pregnancies and eclampsia during two of her confinements.

*Present history.*—The patient was attending the out-patients' department, and had a trace of albumin while three months' pregnant, which cleared up completely with treatment. She was constipated and her bowels had to be moved daily with laxatives. She kept well for 4 to 5 months but subsequently she started getting shivering attacks 2 to 3 times a day. She complained of pain in the left loin about 2 days before admission.

*Condition on admission.*—Healthy looking woman, temperature 90°F., pulse 92 per minute, tongue red and exfoliated due to large doses of alkalis. Uterus: full term size; L. O. A.; foetal heart sounds good; head not fixed. Urine: scanty, acid, albumin, pus cells and micro-organisms present. Blood pressure was within normal limits, the systolic being 116. Fits appeared to be hysterical.

Alkalis were continued in large doses and bowels kept moved. She got no more rise of temperature or pain in the loin, and by the 15th the urine was completely free from albumin, pus cells and micro-organisms. She had no fits for 11 days and was

therefore discharged on request to come back for delivery when pain started.

On 30th November, I was called again at 10-15 a.m., and found the patient suffering from a severe type of eclampsia, fits having started at about 8 a.m. She was getting fits one after another, and was completely unconscious. She had also become cyanosed and had bitten her tongue. She was given an injection of morphia and atropine immediately; this brought the fits under control but she remained unconscious. She was removed to the hospital and given an enema which had no effect. The catheter specimen of urine was high coloured and contained a fairly large quantity of albumin. Systolic pressure 116. Patient was not in labour as there was no uterine contraction; head was above the pelvis and no show was seen. Pelvic examination was not done in view of the contemplated Caesarean section which was done at 1 p.m. A cyanosed female child was delivered. She got no more eclamptic fits after the operation and became conscious after about 7 hours. She behaved like a mental patient on the second day and got a temperature of 100°F. accompanied by shivering. The urine showed pus cells again. She was put on alkalis. Mother and baby are now both doing well.

*Points of interest.*—The case is of interest because the patient was kept under observation; urine was free from albumin till 8 days before the attack; bowels were kept moved and blood pressure was normal yet she developed severe eclampsia. Bowels had moved well that morning also and the patient was feeling quite well.

This is the second case under my care who developed eclampsia while the urine was kept free from albumin till a few days before the attack.

## VESICAL CALCULUS IN A VAGINAL CYSTOCOELE

By R. D. MACRAE, F.R.C.S.E.

CAPTAIN, I.M.S.

Agency Surgeon, Gilgit, via Kashmir

A MOHAMMEDAN multipara was admitted in the second stage of labour. There was delay in the advance of the head through the lower canal.

Examination revealed that a normal labour was taking place, but a hard mass was felt in the anterior vaginal wall, and a cystocoele was seen to bulge below the pubic arch obstructing the progress of the head.

A no. 10 male silver catheter was passed per urethrum, with the tip pointing posteriorly, and, after taking a specimen of urine, the catheter was felt to grate against a stone in the cystocoele.

The bladder was incised through the anterior vaginal wall, and a stone about the size of a walnut removed. The fistula so formed was carefully sutured in two layers, and delivery completed by forceps so as to avoid prolonged pressure on the sutured wound.

Recovery was uneventful except for some cystitis, and no fistula resulted.

## CORRIGENDUM

In the paper on 'Tuberculosis of the Female Genital Tract' by M. N. Sarkar *et al.*, published in our May 1941 issue, on page 259, under the heading *Summary and Conclusions*, para (2), line 3 should read 'From the post-mortem figures the incidence was 1.1 per cent in unselected deaths in females, and where death occurred from tuberculosis the percentage was found to be 8.9'.

The mistake originated in the authors' typescript.

\* Rearranged by Editor.

# Indian Medical Gazette

JUNE

## PLASMA TRANSFUSION

PLASMA transfusion is not such a new-comer to the field of therapeutic medicine as is generally supposed. Its use in casualty-clearing stations was advocated by Ward in 1918, and thereafter for the next eighteen years a few reports of plasma transfusion have appeared in the literature. Recently, however, a combination of factors has occurred that has raised it from an empirical to a scientific procedure. These factors are the knowledge gained by the study of wound shock, hæmorrhage and burns from a physiological standpoint; the availability of large amounts of plasma from blood banks; and abundant clinical material in the form of war casualties.

Plasma is the fluid element of blood after separation of the corpuscles, as distinct from serum, which is the clear fluid which separates off when blood clots. It can be prepared either by sedimentation or by centrifugation, and plasma obtained by either of these methods can be rendered into a powder by desiccation. The technique of obtaining plasma by sedimentation is relatively simple, and consists briefly of aspirating the clear supernatant fluid from citrated blood that has been stored for not less than 24 hours at 4°C. Centrifugation is the method used by the army blood transfusion service in England, and their technique includes an efficient system of clarification and sterilization by the use of filters.

Freshly-obtained blood is kept at about 4°C. for one day and then raised to room temperature for six to eight hours. This prevents opalescence in the plasma, which is the result of separation of fat globules. The blood is then pooled and run through an Alfa-Laval centrifuge, which operates in a manner similar to the domestic cream separator. The plasma thus obtained is freed from fat by suction through filters of sterile cotton pulp, and sterilized by passage through a Seitz filter. The asbestos pads of this filter also adsorb practically all fibrinogen and prothrombin.

This process yields about 50 per cent of the original blood volume (including added anticoagulant), and four workers can prepare 150 pints in four hours. Thus prepared, plasma will keep for at least six months:

To neutralize iso-agglutinins, either the blood or the plasma can be pooled. If B blood is added to A blood in the proportion of at least 1 to 16, then the resulting plasma will contain either no agglutinins or agglutinins of so low a titre as to be negligible. Plasma from blood, freshly drawn for the purpose, is preferable to that obtained from 'banked' blood, into whose

plasma layer considerable diffusion of potassium occurs after a time.

The properties of plasma are identical with those of blood, *minus* the properties attributable to the corpuscles. It contains albumin and globulin which maintain the osmotic pressure, some fibrinogen which assists in hæmostasis, and specific antibodies which remain active in stored plasma for a limited time. The value of plasma transfusion in shock from injuries and burns can be appreciated by studying the sequence of events which McDowall calls the 'death cycle'. In a case of shock, lowered blood pressure reduces the blood supply to the tissues, resulting in asphyxia of the tissues. This causes dilatation of the capillaries and increased permeability of the capillary walls. The dilated and damaged capillaries withdraw a great quantity of blood from the circulation, and permit loss of plasma into the tissues. Hæmoconcentration, a marked feature in cases of burns, and reduced venous return cause reduced cardiac filling. The resulting reduced cardiac output helps to lower the blood pressure further, and thus the vicious circle is complete.

Plasma transfusions, therefore, would seem to be the ideal measure in cases of surgical shock and burns, as they break the vicious circle by causing a permanent increase in the volume of circulating blood, and help the corpuscles to return from the capillaries into the general circulation. In addition, numerous other indications of varying importance have been given for its use, such as hæmorrhagic intestinal states, peritonitis after rupture of a viscus, and œdema due to nutritional and nephrotic states.

The administration of plasma transfusions is relatively simple. The patient's blood group need not be known, and the plasma can be given in the same apparatus as is used for the transfusion of stored blood. Witts recommends the giving of plasma to any shocked patient whose percentage hæmoglobin is 10 per cent above the probable previous value. If this was 100, the plasma loss can be calculated from the formula

$$\frac{\text{Hb}}{100} = \frac{5}{5-x}, \text{ where } x \text{ is the plasma lost in litres*}.$$

If permanent improvement in the patient's condition is to be maintained, a reasonably quantitative replacement of protein must be made. In injury cases a watch on the blood pressure is the best practical guide to a patient's progress. A dangerously low blood pressure in the presence of severe injuries demands immediate transfusion. Cases whose blood pressures

\* The danger of this method of calculating is obvious, unless by any chance one knows the patient's previous hæmoglobin level. At a recent meeting of the Royal Society of Medicine a speaker said in this connexion that hæmoglobin of 115-120 per cent meant that that patient was in extreme danger of immediate death. In this country the average hæmoglobin of well-to-do Europeans is about 130 per cent, so that we must all be dead!

decline or fail to exceed 100 mm. in spite of routine resuscitation measures should be transfused.

A rise of 10 to 20 mm. per 540 c.cm. of plasma given should occur if no causes of loss of circulatory fluid are still operating. If it is found that the administration of more than 1,500 c.cm. is necessary, Whitby advises that 500 c.cm. of this should be blood.

One of the advantages of plasma transfusion is that it is a safe and adequate substitute for whole blood in cases where the addition of corpuscles to the circulation is not required. In this connexion, however, it should be remembered that plasma will perform what has been called auto-transfusion by setting free quantities of corpuscles which have become lodged in the capillaries. Its advantage over crystalloid and gum transfusions is that it causes a permanent restoration of blood volume in a physiological manner.

Dried plasma is stable, and its small bulk and portability are important advantages in certain circumstances.

The disadvantages of plasma are those met with in the technique of preparation, especially when stored blood is used. It must not be forgotten that some cases require to be given very large amounts of plasma, and if one case consumes the contributions of fifteen donors the labour and expense that this represents assume formidable proportions.

Recent work on the use of serum instead of plasma suggests that there is little to choose between them. Serum is certainly easier to dry than plasma, as it contains no fibrin, sodium chloride, sodium citrate or glucose. But at present the consensus of opinion is in favour of the use of plasma.

In England, to use Riddell's phrase, plasma has become a commodity of national importance. It is hardly likely to assume such a degree of importance in India, especially as the success of large-scale transfusion services in democratic countries depends on the willingness of the general public to come forward as donors.

W. McN. N.

## Special Articles

### TREATMENT OF FRACTURES OF THE LEG

By MAX SCHECK, M.D.

*Purandhar, via Poona*

ALTHOUGH he may be equipped with several textbooks on fracture treatment, the surgeon will often find no reference to his particular case. It is the task of this article to outline general rules for treatment of fractures of the tibia or of both bones of the leg. The aim of fracture treatment is complete anatomical and functional restoration. Proper alignment of the fractured ends and healing is almost always connected with good functional results. We therefore must endeavour to reduce the fracture and to keep the fragments in the proper position for as much time as is required for the healing. There are different ways of serving this end. Manipulation, extension, open reduction, with or without fixation, by means of plates or wires.

One school prefers open reduction a few days after the occurrence of the fracture. Even if the danger of infection is ignored, this method does not seem to have any advantage over other non-operative methods. It is argued by the conservative school that the removal of blood, serum and the products of necrosis from the fractured ends and the torn periosteum during operation is harmful to the healing process. In plants there is definite proof that injuries to the stem result in the production of a hormone which stimulates growth. Though the existence of such a hormone is only hypothetical in human

beings, the conservative school regards it as essential to preserve the fluids at the site of the fracture. Only fractures of the patella and the olecranon are treated by open methods.

If we choose closed reduction we have two means at our disposal of achieving alignment of the fragments, manipulation and extension. Both can bring about alignment, but the proper position must be maintained for a sufficiently long time to have a good anatomical and functional result. A plaster-of-paris cast serves this purpose only with limitations. Thus when the muscles are relaxed it will be possible to reduce a spiral fracture by manipulation. X-ray controls after a few days will however reveal considerable displacement, even if an unpadded plaster had been applied. This is due

to the fact that the fragments are under the constant influence of the muscular tube which surrounds the bone (figure 1).

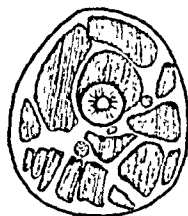


Fig. 1.—Diagram of the thigh showing the muscular tube surrounding the bone.

The muscles have a certain tonicity which is maintained as long as they are innervated. If there is shortening of the bony skeleton, the muscles adapt themselves at once to the new length. In attempting to reduce a fracture this muscular force is such an obstacle that in many cases general anaesthesia is required to make the muscles relax, in order to align the fragments

through our manipulations. Through muscular action the two fragments are pressed in different directions and if primary manipulation has achieved alignment of a spiral fracture and a plaster cast has been applied immediately it is still possible for the fragments to slip (figure 2). If in such a case extension is used for 2 to 3 weeks to counteract the muscles, and a plaster is applied thereafter, no slipping will occur because the fragments are already in a firmer connection.

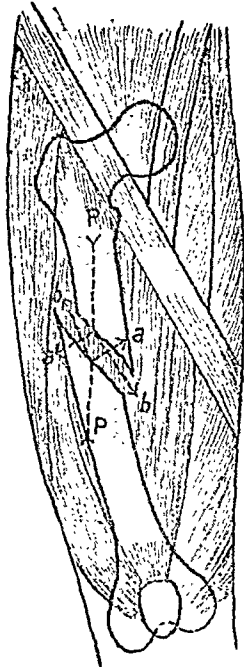


Fig. 2.—Spiral fracture of the femur. The muscular forces *P* are divided according to the parallelogram of forces into the two components *a* and *b*. The forces *a* which tend to keep the fragments together are smaller than the forces *b* which make them slip from each other.

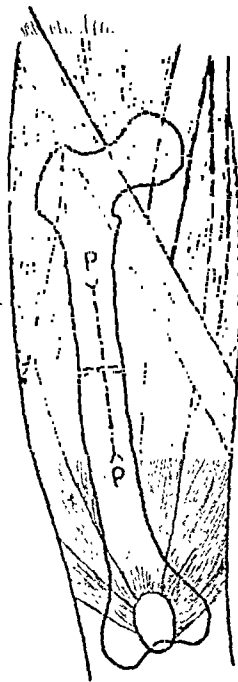


Fig. 3.—Transverse fracture of the femur. The forces *P* act entirely to keep the fragments together.

Fractures with transverse break lines derive only benefit from the muscular pressure, which in its full force presses the fragments together. The pressure is not only welcome for this reason, but also because, according to Roux, pressure favours the formation of bony callus (figure 3).

As the first rule we can therefore establish, that the treatment of fractures of the leg depends on the type of the fracture. We can discriminate between two principal groups—fractures with transverse lines and fractures with oblique lines. Transverse fractures can be primarily set and put in plaster. Fractures with oblique lines, as a rule, must be put under extension before a plaster can be applied.

Whether manipulation or extension shall be done will furthermore not only depend on the type of the fracture but also on the eventual complications of the case. If the type of fracture suggests pin or Kirschner wire extension on

the heel, but this is made impossible on account of a wound sustained in the same accident, some other form of treatment must be adopted. A compound transverse fracture with developing gas gangrene will not be put in plaster but extension with small weight will be applied. The leg is thus always open to inspection and every spread of infection can be watched. The method of treatment will also be decided by the particulars of the case.

#### *The treatment of fractures with transverse lines*

These very often occur through a direct kick on the leg by the opponent when playing football. Clinically, we find more-or-less swelling, pain, loss of function, and crepitation. X-ray reveals a transverse fracture without or with displacement. If there is no displacement the leg is put in a plaster slab which is U-shaped and goes from the medial side of the thigh along the inner side of the leg, round the heel like a stirrup and returns to the outer side of the thigh (figure 4). The slab is made out of two plaster bandages 4 inches broad by putting them in layers in the required length. A thin layer of cotton is put on the inner surface of the slab before it is applied. It is then tied to the leg by a moist gauze bandage, after small cuts have been made on the anterior margins at the height of the ankle joint, in order to make the slab mould to the shape. This plaster, as described by Burns, keeps the fragments fixed and has the great advantage that there is no danger to circulation, because the front and the dorsal surface of the leg are free from plaster. If the patient feels pain the gauze bandage is cut over the skin.

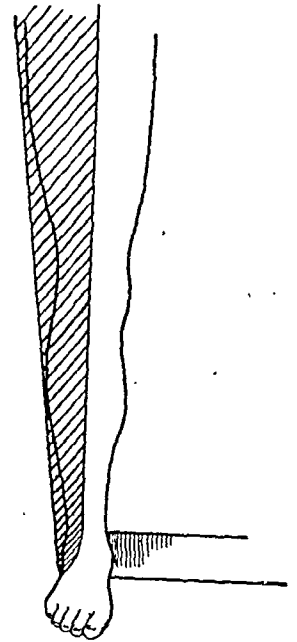


Fig. 4.—Application of the U-slab.

I would advocate this kind of plaster in every case of fracture when no x-ray is available and which has to be transferred to a hospital over a long distance. In war-time and in up-country practice this method would be very useful. The time required to apply it is a very short one, it is however more expensive than a wooden or metal splint.

To avoid rotation of the lower fragment, patella, shin and second toe must be kept in one line. The slab is kept till the swelling has diminished (5 to 8 days) and then the permanent plaster is applied. Bony prominences are covered with small pieces of cotton or lint. A slab is prepared from two plaster bandages



4 inches broad and applied dorsally on the thigh, leg, and sole. It is tied with a moist gauze bandage. Three or four plaster bandages are used for circular application. No walking-iron is used in this case because the pressure of the body-weight is beneficial to the fracture. The walking-iron serves the purpose of transmitting the pressure from the knee directly to the ground, omitting the fracture. If no walking-iron is used the pressure is transmitted through the fracture. The patient is allowed to walk when the plaster is dry and he is discharged from hospital when there is neither swelling nor pain. He is asked to return after 5 weeks when the plaster is removed and the fracture tested clinically and by radiography. If the fracture appears healed and x-ray shows good progress a short plaster up to the knee is applied for 3 weeks. The patient is advised to use his leg freely and to move the knee joint. If there is still movability of the fracture a long plaster must be applied for another 4 weeks. Sometimes a third plaster is required.

No definite time expressed in weeks can be given for all the cases. If the fracture is healed but swelling is persistent, Unna's paste bandages are applied for 2 to 3 weeks. After fractures of the leg, patients often complain of pain in the ankle joint when walking. This is due to traumatic valgus deformity as the result of disturbance of the muscular equilibrium which keeps the foot and its arches in the right position. In these cases a support is given to the foot to relieve the valgus position. Metal is certainly the most suitable material.

If there is displacement to the side and shortening, reduction is done under local or general anaesthesia and after alignment a U-slab is applied. A few days later the permanent plaster is applied. The course of treatment is the same as described above.

It is necessary to discuss at this point the treatment of compound fractures. Whereas in simple fractures our first and last aim is the anatomical and functional restoration in compound fractures, we must first endeavour to prevent or check infection, although we keep in mind the ultimate result. If seen within 6 hours, wounds in general can be considered as contaminated but not infected. The contamination occurred when through the skin opening bacteria from the surroundings have been brought into the wound. The bacteria find themselves in a medium to which they are not accustomed. Within 6 hours they get used to the new medium and their power for invasion, which was so far only potential, becomes a danger to the organism. The success of the bacteria will also be decided by the effectiveness of the resistance of the tissue. Crushed and devitalized it will easily succumb, whereas healthy tissue has natural powers of resistance. If a wound comes under our treatment within the first 6 hours after the accident, we can

remove most of the bacteria and of the devitalized tissue by excision of the wound margins and of the bottom of the wound. If this has been done the wound can be closed by sutures, but no deeper-lying tissue such as muscle tendons or fascia shall be sutured if the wound was grossly contaminated. The only exceptions are nerves and vessels whose suture should always be attempted. But the surgeon has to work very judiciously and must not put down the scalpel until his eye fails to discover any more dirt or crushed tissue. Even parts of muscle tendons and bones must be dissected if they are grossly contaminated. If the wound is very deep and with pockets which the surgeon cannot reach without serious injury to vital structures he has to leave the wound open. In many cases a compromise is possible by suturing the wound and inserting under it a cigarette or glove-drain which is put in from a stab incision 2 inches away from the wound (figure 5). The drain is removed after 24 hours and such a procedure leads in most of the cases to healing by first intention. No antiseptics are used, the wound is only cleaned with soap, water and ether. The wound margins are painted with tincture of iodine. Care is taken that none of the antiseptic touches the wound proper. All is left to the cleaning by the surgeon's scalpel.



Fig. 5.—Drainage of a recent compound fracture.

The same rules apply to compound fractures if seen within the first 6 hours. We first convert the compound fracture into a simple one by excision, suturing and eventual drainage. If there is not enough skin to cover the fracture, an attempt must be made to get it from somewhere else, either from the vicinity by incisions relieving tension so that the wound margins can be approximated over the fracture or even by skin grafting. Many cases have been reported where Reverdin grafts have taken nicely and thus the prolonged illness through a discharging compound fracture has been avoided. Thiersch grafts do not usually take well in compound fractures because the bone is often devoid of periosteum.

If a fracture lies open, infection to a lesser or greater degree is bound to occur, since bone is a very susceptible structure. In a comminuted compound fracture not too many bone pieces should be removed, failing which rule non-union often occurs. Protruding bone spikes should be removed with a Liston forceps and contaminated corticalis should be nibbled off. Only if thorough mechanical cleaning of a protruding fragment has been done, can it be brought back into the wound. If the wound is closed, it is covered



with sterile dressings and the fracture treatment is started; according to the type of fracture, plaster with a window over the wound or extension is used. If manipulation is necessary, *e.g.*, in a displaced transverse fracture, it can be done at this stage. If however an x-ray control after 4 to 5 days reveals that there is still displacement, no attempt at reduction is justified until the wound is healed by first intention, because before this time a silent infection might be stimulated.

If as a rule plaster alone is used in the treatment of transverse fractures, we have to consider cases where for one or the other reason plaster cannot be applied. In compound transverse fractures with gas gangrene or cellulitis, it is better to use pin extension with a small weight, which keeps the fracture at rest and enables us to watch every spread of infection, since the leg is not in a plaster cast.

A transverse fracture can also occur at the head of the tibia through a fall on the ground in upright position. If there is no concomitant fracture line running into the joint and no shortening, the same treatment is used as in other transverse fractures.

#### *Treatment of fractures with oblique lines*

According to the force causing the fracture we can differentiate between five types in this group. Manipulation and immediate plaster mostly fail to give a good anatomical result. Extension for 2 to 3 weeks or longer has to precede plaster treatment.

*Type 1.*—This type of fracture is caused by shearing force. When in standing position the leg is hit by a violent force, such as a log rolling down a slope, the upper part is sheared off from the resting and fixed lower part. It results in an oblique fracture line with displacement to the side and shortening. A Kirschner wire or pin extension is established on the heel under local anaesthesia. Extension weight of 8 to 10 pounds is used and the leg is placed on a Braun-splint, or one of its modifications (Boehler, Eiselsberg). A stockinet sock is fixed to the skin of the fore-foot by mastisol and the tip of the sock is tied to the horizontal bar of the upright frame, in order to prevent dropping of the foot. The fracture is open to inspection; blisters are left as they are. They are clipped off a few days after when epidermis has formed underneath. The knee is in a semi-flexed position. After a few days an x-ray examination of the leg in the splint is carried out by means of a portable machine. According to the position of the fragments weight is increased or diminished: if one fragment is displaced to the dorsal side, it can be lifted by a cotton pad placed beneath it. Displacement to the side can be corrected by side traction. A pulley is fixed to the side by a special frame mounted on the splint. If the alignment is good, plaster can be applied, after 2 to 3 weeks, on the orthopaedic table. The extension arch is fixed on the footpiece of the table.

To leave the pin with the arch has the advantage that we can still correct shortening without the help of an assistant. The dorsal plaster slab can also be more easily applied.

Many fractures show a spring-like resistance against alignment. By pressure with the palm on a fragment (it is in this type of fracture the upper fragment which is displaced medially) reduction is possible. But as soon as the pressure ceases the fragment returns to the old position. In these cases, I control, under the screen, where the pressure has to be applied and how much of it has to be used. Then a dorsal slab is applied up to two-thirds of the thigh. The nurse is advised to put only two plaster bandages in the water for immediate use. These are used only for plastering the lower leg. Then pressure is exercised on the fragment with the palm. Short screening reveals the effectiveness. If the fragments are reduced the pressure is maintained and the plaster allowed to harden. Another short screen control is done and then the plaster is completed by circular bandages and a walking-iron. The pin and arch are still included and removed after 2 to 3 days.

Further treatment is the same as described above. The period of plaster treatment will be slightly longer and the application of a second long plaster including the thigh will in most cases be necessary. If a wound on the heel prevents us from establishing pin extension, though the type of the fracture suggests it, a plaster is applied up to the knee. When the plaster has hardened a strap of lint 3 inches broad is put on its sides in a U-shape, the horizontal bar of the U forming a loop at the distance of 3 inches from the sole. The strap is then fixed to the plaster by a plaster bandage. The loop gives us a handle for extension which will act on the lower fragment. Over the heel, a window is cut out of the plaster and dressings applied to the wound. When the wound is healed necessary corrections in the position of the fragments are made and a plaster applied up to two-thirds of the thigh.

*Type 2.*—A wedge-shaped bone piece is forced out of contact from the resulting two fragments by a violent direct hit on the leg. If there is no displacement it can be hoped that the periosteum is not torn and that it will keep the fragments together. Primary plaster treatment can be tried. If there is considerable displacement of the wedge to the side, it is advisable to use extension. If a compound fracture of this type comes under our treatment within the first 6 hours the wedge should not be removed. In the case of osteomyelitis the wedge should be kept as long as there is no sign of necrosis. Removal will often lead to non-union and it could have been avoided in many cases.

*Type 3.*—Spiral fractures of the tibia and fibula occur through impetuous turning movement of the body when the foot is fixed.

there is no displacement and the fibula is not broken, as well as in green-stick fractures, primary plaster can be applied. Slight angulation and displacement however will induce us to apply extension because the displacement often becomes worse in a plaster cast. As a rule extension is applied. Care must be taken that bony spikes do not exercise pressure on the overlying skin and thus cause an ulcer. Angulations, displacement and shortening can be corrected in the same way as described before. If the upper fragment is displaced ventrally, this is due to the action of the quadriceps muscle. This can be relaxed by giving the knee a less flexed position through adjustment of the splint. When for some reason pin extension is impossible, a plaster-lint extension can be applied. After 2 to 3 weeks the leg is put in plaster under screen control. When attempting to correct drop-foot it often comes to recurvation of the fracture because the ankle joint is to some degree stiffened. This can be avoided by putting one hand under the fracture and correcting at the same time the position of the foot. Spiral fractures with short fracture lines sometimes show after 2 to 3 weeks' extension a more than usual movability. In these cases a second wire or pin is inserted through the head of the tibia. The fracture is reduced and plaster applied up to two-thirds of the thigh. The plaster between the two wires acts now as a strut and an inner unstable system is connected with an outer stable one. The patient can walk in this plaster and the wires are removed after 2 weeks.

Should a wound on the heel prevent wire extension in this type of fracture, plaster-lint extension is used.

*Type 4.*—Fractures of the head of the tibia with broadening of the head and fracture lines running into the joint occur through a fall on the heel in upright position. The two condyles are forced apart and broadening of the joint surface would, if not treated, result in a serious setback to function. Through extension on the heel, the

shortening can be corrected, and partly the broadening. If the reduction is complete extension is left for 6 weeks. If there is still broadening after 3 weeks' extension treatment the patient is put on the orthopædic table. Two wooden sticks with rectangular diameter (1 inch by  $2\frac{1}{2}$  inches) are bound together by a rope so that the broad sides face each other (figure 6). They resemble now a nutcracker

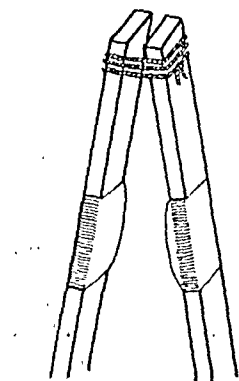


Fig. 6.—Nutcracker for compression of the head of the tibia.

between whose branches the condyles are placed (figure 7). The fastened ends are at some

distance below the knee. In order to avoid injury to the peroneal nerve the nutcracker is slightly turned so that the outer branch is more in front. The branches are padded with cotton-wool and pressure is exercised to approximate the condyles. If this is done plaster is applied up to two-thirds of the thigh for 4 weeks. Intra-articular fractures often lead to stiffening of the joint and we reduce the duration of the plaster cast to a minimum. After 4 weeks the plaster is removed. The leg still needs a support, but the knee joint must be allowed movement. A plaster is applied including the thigh, and after hardening, it is cut in the region of the knee joint leaving some space between the halves. The two parts have, however, to embrace the condyles of tibia and femur, respectively. Only over the patella a bigger half-circle is cut out of the upper cast. Then a hinge joint with longer iron bars is fitted to the plaster on the medial and lateral sides and fixed by plaster bandages. Their axis must correspond to the true joint axis. Thus, the pressure is taken from the fracture and movements are possible. The patient is advised to walk and to exercise his knee joint. After 4 weeks the plaster is removed and physical treatment started.

*Type 5.*—Fractures caused by gunshot, flying projectiles, or bomb splinters are mostly compound ones. The amount of damage done to the tissues and to the bone vary with the type of projectile, the velocity, the distance, and whether it is a direct hit or a ricochet. They range from simple holes in the skin and smashing of the corticalis to extensive crushing of the skin and comminution of bone. In cases where

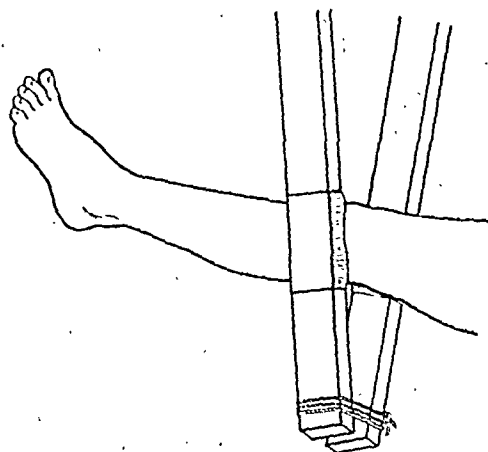


Fig. 7.—Nutcracker applied to the leg.

there is only a simple hole in the skin and the projectile is visible in the wound, excision of the wound margins and extraction of the foreign body and bone splinters can be done. If there is extensive crushing of tissues with comminution of the bone, no attempt is justified to probe the wound and to extract the bullet. If deep pockets are encountered, counter-incisions are done. But that should be the only surgical

(Continued at foot of next page)

## MEDICAL PRACTITIONERS AND MEDICAL RELIEF AT THE MOGHUL COURT DURING THE REIGN OF AKBAR THE GREAT

By D. V. S. REDDY, M.B., B.S.  
Andhra Medical College, Vizagapatam

### *Five classes of learned men at the court*

ABUL FAZL classified the learned men of the time according to their knowledge. Five classes of men are mentioned as worthy of attention.

'The first class, in the lustre of their star, perceive the mysteries of the external and the internal, and in their understanding and the breadth of their views fully comprehend both realms of thought and acknowledge to have received their spiritual power from the throne of His Majesty.

'The second class pay less attention to the external world; but in the light of their hearts they acquire vast knowledge.

'The third class do not step beyond the arena of observation (*nazar*) and possess a certain knowledge of what rests on testimony.

'The fourth class look upon testimony as something filled with the dust of suspicion, and handle nothing without proof.

'The fifth class are bigoted and cannot pass beyond the narrow sphere of revealed testimony'.

The classes can be summarized thus; each class has many subdivisions.

First class : such as understand mysteries of both worlds.

Second class : such as understand the mysteries of the heart.

Third class : such as know philosophy and theology.

Fourth class : such as know philosophy.

Fifth class : such as understand sciences resting on testimony.

(Continued from previous page)

intervention on the wound, apart from a sterile dressing. If only one wall of the corticalis is smashed, a plaster should be applied with a window over the wound. If the fracture is a comminuted one, pin extension should be used.

### *Summary*

1. The treatment of fractures of the tibia alone and of such combined with fractures of the fibula is decided by the type of fracture. Fractures with a transverse line do not need extension, whereas as a rule fractures with oblique lines will first be submitted to it.

2. Complications endangering the limb or the life, and those preventing us using the pin extension will induce us to modify this rule.

It is interesting to note that Abul Fazl includes the doctors in the fourth group. Blochmann explains that Abul Fazl takes the term philosophy to include 'testimony based on human reason'. In this wider sense, the scholar-physicians of the age naturally fall into the fourth group along with the mathematicians and astronomers.

Akbar's court was a permanent committee of intellectual co-operation, in philosophy and religion, literature, and medical science. The catholic tastes and liberal patronage of the Emperor attracted scholars and physicians of all nationalities, and religions. The Hakims, the Hindu physicians or surgeons, and European doctors stood side by side, basking in the brilliant sunshine of the Moghul patronage.

### *Moghul physicians and surgeons*

Most of the Mohammedan physicians at the court were immigrants from Persia and Khoorassan. We have very little knowledge of many of the doctors beyond their names. Mulla Mir, Hakim Aristu, Hakim Nimatullah, Hakim Dawai, Hakim Talab Ali, Hakim Abdur Rahim, Hakim Rohullah, Hakim Fakhruddin Ali, Hakim Ishaq. *Tabaqat* gives the following additional names : Hakim Jalal-ud-din Muhammad Ardithani, Mulla Miran Sulaiman, Hakim Ahmed Tatui, Mullah Shahabuddin (a Gujarati Hakim), Hakim Ahmed Gilani (pupil of Hakim-Ul-Mulk).

More information is available about some other doctors. Hakim-Ul-Mulk, whose real name was Shamsuddin and who came from Gilan, was a very learned man. He knew philosophy and the science of medicine. Hakim Hassan, also from Gilan, was not very learned but was an excellent man. Hakim Zambil Beg was a personal attendant on the Emperor. Hakim Fathullah, also from Gilan, knew a great deal of medical literature and astronomy; he wrote a Persian commentary on the 'qanun' of Avicenna. He left India during Jehangir's time, but his grandson Fathullah was a doctor during Shah Jehan's reign. Hakim Masih-ul-Mulk of Shiraj came to the Deccan and was a physician to Sultan Murad. Hakim Lutfullah came from Gilan and was a learned doctor in the service of Her Highness Mariam Makani. Hakim Shifai was a friend of Shah Abbas Cafawi and came to India. He was a poet also. Hakim Misri was a very learned man and a clever doctor. According to the fashions of the age, he also wrote poems. He was a man of most amiable and unselfish character. Abul Fazl visited him when he was on his death-bed in Burhanpur. Hakim Ruknuddin and Hakim Sadra arrived in India, in the later days of Akbar.

Brief but definite information has been preserved for posterity in the case of the following doctors :—Hakim Saiful Mulk Lang, came from Dama-wand and was in Agra during Bairam's regency. He was also a poet. He returned to his native place after some years at the Moghul's

court. Badaoni and *Tabaqat* both call him Saiful Mulk. He is said to have got the nickname of 'Saiful Hukuma' which means 'the sword of the doctors' because he killed his patients. Shaik Hassan and his son Shaik Bena came from Paniput, and were renowned surgeons. *Tabaqat* mentions that Shaik Hassan had great skill in surgery and was wonderful in the treatment of elephants. Father and son succeeded in curing a bad wound which Akbar had received from a buck at a deer fight. Shaik Bena's son is the well-known Shaik Hassan (Muqarab Kahn) who, under Jehangir, rose to great honours and was made governor of Gujarat, in which capacity he came into contact with the English at Surat in the early years of the 17th century. Muqarab Khan's son Rizqullah was a doctor at the court of Shahjahan. Shaik Hassan may therefore be considered as the progenitor of a distinguished family of surgeons and physicians.

Another surgeon is mentioned in *Tabaqat*, 'Mulla Qutubuddin Kuhlhal had great skill in surgery'. Hakim Jalaluddin Muzaffar came from Ardistan in Persia. He was first a doctor at the court of Shah Tahmasp and reached India when he was still young. Contemporary writers praised the purity of his character and walk of life. His theoretical knowledge is said to have been limited, but he was looked upon as a very experienced doctor. He is one of those physicians who had a political career. He served first in Bengal and later in Gujarat, during the reign of Jehangir. He was made a commander of three thousand. It is said that Jehangir was fond of him because he was one of the companions when he was a prince rebelling against Akbar. This Hakim was accidentally poisoned by his own compounder. He was also well known to contemporaries as a victim to a disease of the lungs, *garhah-i-shush*, for about 20 years before his death. It was believed that in spite of the disease he prolonged his life by his uniform mode of living. The interesting clinical condition from which he suffered has been recorded and will be reproduced in another place. Hakim Ain-ul-mulk Shirazi, a very learned man, had a high rank in the science of collyriums. Akbar liked him much. The Hakim later filled many high posts (Cadr of Bengal, Bhakshi of Agra).

#### *Three eminent scholar physicians*

One may now proceed to give sketches of the three most distinguished physicians at the court, who were also great scholars and personal friends of Akbar. Hakim Abul Fath, son of a learned Cadr of Gilan, fled to India with his distinguished brothers, Hakim Human and Hakim Nuruddin, when Shah Tahmasp conquered Gilan and began to persecute the people. They sought the patronage of the Moghul court and were well received. Abul Fath was first made Cadr and Amin of Bengal. Later, he went to the Moghul court and rose rapidly. He

was one of Akbar's favourites and possessed immense influence in state matters and on the emperor himself. Badaoni mentions Abul Fath's influence as one of the chief reasons why Akbar propounded his new religion. The Hakim went with the Emperor to Kashmir and from there to Zabulistan. On the march, he fell sick and died. During the return journey, Akbar stopped and prayed at Abul Fath's tomb. Abul Fath was as arrogant and insubordinate as he was learned and clever. It is said that Akbar ascribed the disastrous issue of a campaign in the north to the Hakim's insubordinate conduct and reprimanded him. Badaoni also mentions that he used to speak contemptuously of old Persian poets. There is, however, no doubt that he was both brilliant and learned. Abul Fazl and Badaoni speak of the vast attainment of Abul Fath. Even the contemporary poets sing his encomiums. Urfi of Shiraj and the great Shaik Faizi honoured him in their poems. The latter mentions the Arab doctors, Al-Faryall and Avicenna, before referring to Abul Fath as a doctor.

Hakim Humam, one of the nine gems of Akbar's court, was the brother of Abul Fath. His real name was Humayun. He began to call himself Humayun Quli (slave of Humayun) when he reached Akbar's court. After some time Akbar himself gave the physician the name of Humam. He was the chief physician of King's harem. His official position was that of Bakawal Beg, or master of the kitchen. This was a very responsible post in the Imperial household, requiring sincerity, insight, and honesty, as the officer had to deal with preparation of the estimates for the foodstuffs, selection of articles and preservation, cooking of various dishes, and finally testing and safeguarding against possible mischief, in the transit to His Majesty's table. He was also a personal friend of Akbar and possessed great influence. He was a man of culture and wit and a brilliant conversationalist. Akbar often said that he did not enjoy his meals during Humam's absence, which was due to his being sent as an ambassador to Turan. Humam died in the fortieth year of Akbar's reign, leaving two sons, Hakim Haziq and Hakim Khushhal, who occupied some posts during Shahjahan's reign.

Hakim Ali of Gilan may be described as the greatest of the physicians at Akbar's court. He is also the best known amongst them. Ali came poor and destitute from Persia to India, but was fortunate enough to become, in course of time, a personal attendant and friend of Akbar. According to Badaoni, he learned medicine and science under Shah Fatullah of Shiraj, who excelled in natural philosophy and mechanics. On account of Ali's great learning, he was called the Mullah of Gilan and 'the Galenus of the age'. Jehangir writes that Ali composed a commentary on the 'Qanun'. Historians differ widely in their estimates of the

man. Jehangir's opinion of this brilliant physician is worth quoting. 'But his subtlety was greater than his knowledge, his looks better than his walk of life, his behaviour better than his heart; for in reality, he was bad and unprincipled man'. There is even a hint that Ali had killed Akbar. Badaoni states that Ali was a bad doctor, who often killed his patients. He is reported to have killed Fatullah by prescribing *harish* (a dish of crushed wheat, and ghee). To his credit, it may be said that he spent annually Rs. 6,000 on medicines for the poor. His knowledge was beyond question. Once, the Emperor himself tried a little trick to test him. Several bottles of urine of sick and healthy people and even of animals were shown to him, all in one lot. It is said that Ali correctly distinguished the different kinds, to the entire satisfaction of the Emperor. His astringent mixtures enjoyed a great reputation at the court. He treated Akbar immediately before his death. It is said the Emperor died of dysentery or acute diarrhoea, which no remedies could stop. The first attack was caused by worry and excitement, on account of the behaviour of Prince Khusru at an elephant fight for the championship. Akbar went home after the fight much annoyed and sent next morning for Ali, to whom he said that the vexation caused by Khusru's bad behaviour had made him ill. Ali had at last recourse to a most powerful astringent and, when the dysentery was stopped, costive fever and strangury ensued. The Hakim therefore administered purgatives, which brought back the diarrhoea, of which Akbar died.

In the 39th year of Akbar's reign, Hakim Ali constructed the wonderful reservoir (*hauz*) which is so often mentioned by Moghul historians. 'A staircase went to the bottom of the reservoir, from where a passage led to an adjoining small room, six *gaz* square, and capable of holding ten or twelve people. By some contrivance, the water of the reservoir was prevented from flowing into the chamber. When Akbar dived to the bottom of the reservoir and passed into the room he found it lighted up, and furnished with cushions, sleeping apparel and a few books. Breakfast was also provided. Jehangir visited this reservoir and made the Hakim commander of 2,000. But Ali did not enjoy the promotion long, as he died a year later.

#### *Hindu physicians and surgeons*

The information regarding the Hindu physicians at Akbar's court is very scanty. Abul Fazl mentions four physicians; Mahadev, Bhimnath, Narain, and Siwaji. *Tabaqat* adds two more names, Durga Mal and Abi. The same authority refers to three Hindu surgeons, Chunder Sen, Bhairam and Bairjiu. The last is said to be a Gujarati with much skill in surgery and in the use of collyriums. Professor Sri Ram Sharma, writing of the Sanskrit writers

of the age, points out that Kavichandra, Vaidy-  
raja, Todar Mal and Nilakanth wrote treatises on medicine.

#### *European doctors*

That Europeans were in the Moghul service, even during Akbar's reign, is recorded by Abul Fazl himself. There was a colony of Armenians at Agra as early as 1562. Akbar came into contact with the Portuguese priests in 1573 and after that date, there was a regular intellectual free trade between Goa and Delhi.

There is a tradition that Juliana, an Armenian lady, who was in medical charge of the Emperor's harem, built the old church at Agra. Contemporary chronicles and tradition agree that there was a woman doctor, Juliapa by name, at the court of Akbar and that she was given by the Emperor in marriage to Prince Jean de Phillip de Bourbon of Navarre, when this adventurer appeared at the Moghul court. It is however believed that there was at Akbar's court another Juliana of Portuguese origin, with medical proclivities. This is further confirmed by a contemporary letter saying that the Portuguese first gained Akbar's favour through a lady doctor. As regards the European surgeons, no records are available which help us to ascertain the names. It is quite likely that there may have been some Armenian or Portuguese adventurers with some smattering of medical art. Manucci, who recorded the stories he heard in the middle of the 17th century, barely fifty years after the death of Akbar, has definitely stated that there were European surgeons in the service of Akbar and that Akbar was very fond of them.

#### *Courtiers versed in medical lore*

A few other learned courtiers and personal friends of Akbar were versed in medical lore, though they did not profess or practice medicine, as a calling. Amir Fathulla of Shiraz so excelled in all branches of natural philosophy, especially mechanics, that Abul Fazl said of him 'If the books of antiquity should be lost, the Amir will restore them'. Originally a native of Shiraz, he came to India to the court of Adil Shah of Bijapur, at the earnest solicitations of this king. After the death of this patron, he was invited by Akbar, who gave him positions of honour and titles. While staying in Kashmir in the camp of the Emperor, the Amir was attacked with fever and died. It is said that he sincerely believed that he understood the medical art. But, still, he could have taken the advice and prescriptions offered by Hakim Ali, the royal physician and also his own disciple. The Amir refused all medical advice and treated himself, with fatal results. He seems to have tried to cure himself by eating *harish*, which caused his death. He is best known for several of his mechanical inventions. Amir was loved and respected by Akbar, and was also instructor to the son of Abul Fazl. Faizi wrote a fine

ode on the death of the Amir. Sheik Faizi, the poet-laureate of the court and the instructor of Prince Saleem (Jehangir), was not only acquainted with medical science but had a fine collection of books on medicine and allied topics. Badaoni records that Faizi 'had no equals' in that age in such branches of knowledge as history, medicine, etc. He used to give lectures on 'Al-Qanun' of Avicenna. Some contemporaries mention Faizi as Hakim Faizi and also that he practised as a physician. It is known definitely that he had a charitable disposition and treated the poor free of charge.

Raja Todar Mal, a Kshatria by caste, rose to be the Dewan of the great King and remodelled the revenue system of the Moghul Empire. He was no less distinguished for his courage than for his financial abilities. In spite of his bad temper and bigotry, he was a faithful servant of Akbar. When old age and sickness compelled him to resign his high post, Todar Mal, like the orthodox Hindu and the scholar, retired to the banks of Ganges, for a life of study and contemplation. The work on medicine attributed to Todar Mal was probably written at this time.

The Portuguese Fathers at Akbar's court were not only learned in sciences but were also interested in the relief of human suffering. The Fathers were also on very good terms with Hakim Ali, physician to His Majesty. In the last decade of the 16th century, the Portuguese actually opened at Lahore (then the Moghul capital) a school for children of nobility to learn Portuguese. Akbar discussed philosophy and science with the Fathers and acquired a good collection of European books through these Fathers. Father Monserrate was a former professor of Lisbon, who tended the sick during the plague epidemic in Portugal and was acquainted with some elements of medical treatment. Father Xavier, in a letter dated 1598, tells of cases where persons were cured of illness by mere receipt of baptism or by hearing the gospel read to them. Akbar is also said to have approved a scheme for building a hospital and initiating what is now called 'a medical mission'.

#### *Akbar's knowledge and alleged supernatural powers*

Fazl also writes that His Majesty understood how to use elixirs and chemical processes, 'any kind of growth will alter the constitution of the body. Copper and iron will turn to gold and tin and lead into silver. The saying of the wise is true that the eye of the exalted is the elixir for producing the goodness'.

When Akbar became the spiritual guide, people began to believe in his supernatural powers. 'When His Majesty leaves court, in order to settle the affairs of a province, to conquer a kingdom, or to enjoy the pleasures of the chase, there is not a hamlet, a town, or a city, that does not send forth crowds of men and

women with vow-offerings in their hands, and prayers on their lips; touching the ground with their foreheads, praising the efficacy of their vows, or proclaiming the accounts of the spiritual assistance received. Other multitudes ask for lasting bliss, for an upright heart, for advice how best to act, for strength of the body, for enlightenment, for the birth of a son, the reunion of friends, a long life, increase of wealth, elevation in rank and many other things. His Majesty, who knows what is really good, gives satisfactory answers to every one, and applies remedies to their religious perplexities. Not a day passes but people bring cups of water to him, beseeching him to breathe upon it. He who reads the letters of the divine orders in the books of fate, on seeing the tidings of hope, takes the water with his blessed hands, places it in the rays of the world-illuminating sun, and fulfils the desire of the suppliant. Many sick people of broken hopes, whose diseases the most eminent physicians pronounced incurable, have been restored to health by this divine means'.

A passage in Murray's discoveries in Asia, (volume II, page 96) containing an account of the Moghul court derived from the Goa missionaries who came to Akbar in 1595 fully confirms the statement of Fazl.

'He (Akbar) showed himself every morning at a window in front of which multitudes came and prostrated themselves; while women brought their sick infants for his benediction, and offered presents on their recovery'.

One of the occurrences was an outbreak of pimples in the body of prince Sultan Selim. 'This began on 12 Khurdad, divine month, and was accompanied by fever. The loving lord bent in meditation over the pillow of the nursling of fortune's garden and read in the pages of fate that he would be cured. So also did the ascetics, the astrologers and the soothsayers, give tidings of joy. But, as skilful physicians were not confident in diagnosing the disease, the ladies of the harem and the servants in general were not reassured. During this state of suspense, an eruption (*judain*) showed itself, and the physicians also now said that he would recover. In a short time it dried up and a feast was held in honour of his recovery. The world rejoiced and the auspicious gained knowledge about His Majesty's acquaintance with hidden things and made the prostration of benediction'.

A more remarkable case is the following: 'A simple-minded recluse had cut off his tongue, and throwing it towards the threshold of the palace, said, "If that certain blissful thought, which I just now have, has been put into my heart by God, my tongue will get well; for the sincerity of my belief must lead to a happy issue". The day was not ended before he obtained his wish'. The translator and editor of *Ain-i-Akbari* adds a footnote about the blissful thought of this fanatic. It is stated to be of the following nature: 'If Akbar is a prophet he must, from his supernatural wisdom,



find out in what condition I am lying here'. The poor fellow was perhaps observed and succoured.

#### *Akbar's interest in dietetics*

*Ain* 23, entitled Imperial Kitchen, begins with the following introduction: 'His Majesty even extends his attention to this department, and has given many wise regulations for it; nor can a reason be given why he should not do, as the equilibrium of man's nature, the strength of the body, the capability of receiving external and internal blessing, and the acquisition of worldly and religious advantages, depend ultimately on proper care being shown for appropriate food. This knowledge distinguishes man from beasts, with whom as far as mere eating is concerned, he stands upon the same level'.

#### *Akbar as a surgeon*

Fath Khan, the leopard keeper, was in despair about an illness of his eyes. 'Becoming hopeless about physicians he had recourse to supplications, and His Majesty cures him by breathing on him, with his Messiah-like breath'. Abul Fazl thus hints that this was one of the miracles of Akbar and adds 'physicians did not set up their acquired knowledge against the wisdom that was the gift of God and performed the prostration of supplication'. It is however known that Akbar cured Fath Khan's sore eyes by blood letting, a surgical procedure much in vogue at that time.

About the year 1570, occurred an event which throws some light on the current beliefs of the times. Abul Fazl writes, 'One of the occurrences was the arrival of the ambassador of the Rajah of Kajli which is a province of India near Malabar'. Some believe that it was from Cochin. The Rajah was distinguished among the landholders of that part for his territory and wealth. Having received some benefit from *Jogis*, he had since a year adopted their costume and treated them with honour. Anxious to send some rarities along with the son of his Vazier who undertook the adventurous journey to Delhi, but alive to the dangers of the road, this Rajah sent a knife made by former physicians of his country according to talismans and charms. 'Though in appearance it possesses no value, yet its virtue is that whenever it is applied to a swelling it removes it. I make over this rarity to you that you may put it into the hollow of staff and carry it with you so that it may be a memorial of me'. The ambassador set off and after paying homage to Akbar produced the rarity for which he was rewarded. Then comes the testimony of Abul Fazl on the personal experience of Akbar. 'To this day, the knife is in the general treasury. I have frequently heard from the holy lips of His Majesty that more than 200 persons who were near to death obtained health by touching that knife'.

It is said that Shaik Abdul Rahim of Lucknow drank so hard that he got frequently insane.

In one of these fits he wounded himself in Hakim Abul Fath's dwelling at Sailkot. Akbar looked after the wound himself.

#### *Akbar treats a case of poisoning*

'One of the occurrences was that Shaikh Jamal Bakhtiyar was saved from danger of his life by the blessing of the holy spirit of His Majesty. In accordance with this blame-worthy custom, many narrow-minded and envious ones were annoyed by the elevation of the Shaikh and took advantage of the carelessness of the butler to poison his drink. As soon as he swallowed it, there was a change in his condition. Darab, who was one of His Majesty's prominent servants, out of friendship drank some of the same fluid and he too at once fell into a confused state. They remained for a day and night in a dangerous condition. When His Majesty heard of this, he employed medical remedies and also somewhat of spiritual medicines and by the blessing of his attentions they recovered'.

#### *Abul Fazl promises more case reports*

Fazl concludes this section expressing a hope to write a full volume on this subject. Had he not been cut off in the middle of his life by a traitor, who knows what wealth of clinical material and therapeutic achievements of the age and of this sage, would have been available for posterity? 'But it is impossible, while speaking of other matters besides, to give a full account of the manner in which His Majesty teaches wisdom, heals dangerous diseases, and applies remedies for the severest sufferings. Should my occupations allow sufficient leisure, and should another term of life be granted me, it is my intention to lay before the world a separate volume on this subject'. The volume was never begun. Probably, Gods were jealous of Akbar, who would have also become deified, like Divodasa, King of Benares, now worshipped as Dhanvantri, an avatar of Vishnu.

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## Medical News

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### THE TUBERCULOSIS ASSOCIATION OF INDIA

*(Report of sub-committee on classification of pulmonary tuberculosis)*

THE lesson of the tower of Babel has been learnt. Whether we wish to build a tower to reach the skies, or, more ambitiously, to drive tuberculosis out of India, we must all speak the same language, and before we can do that it is necessary to decide what the best language for the occasion is to be.

The sub-committee of the Tuberculosis Association of India, after much labour, has produced a report on the classification of pulmonary tuberculosis.

There is no room for loose terms in the science of phthisiology and when one worker refers to the 'upper zone' or 'the apex', his friend at the other side of the bed, or of India, must know, not just more or less, but exactly what he means.



This is one of the many things that the committee decided (though it is a pity that the printer interposed a comma between apex and its verb). But, important though classification and definition is, there is much more than this in the report; there are valuable details of how to do such tests as the erythrocyte sedimentation rate and how to work out the rather confusing 'indices' which different workers apply to estimate progress.

Every serious tuberculosis worker in India must obtain and study a copy of this report and its valuable appendices.

### ANNALS OF BIOCHEMISTRY AND EXPERIMENTAL MEDICINE

THERE is no dearth of medical publications in India. In recent years, these have increased in number very considerably and each province seems to feel that it must have its own medical journal, and often two or three. This sort of provincial pride will help nobody; it certainly does nothing to further medical knowledge in the country, for, frankly, many of these medical journals are not worth the paper on which they are printed. Their price is usually low, but, if they deflect the poor practitioner's few rupees a year that he can afford to spend on medical literature from being more profitably invested, they are doing positive harm; and everything should be done to discourage them.

A number of specialist journals have also appeared during the last few years. The motive behind the publication of these journals is a very different one; they are often published by some special society or association and though, as we have pointed out before, there is a danger that these journals will tend towards the segregation of specialist knowledge which is obviously undesirable, such journals, some of which maintain a high standard, will eventually take an important place in the country's medical literature.

There still remains the general research, as opposed to clinical, journal. The *Indian Journal of Medical Research* was first published in 1912 and except for its off-shoot the *Journal of the Malaria Institute of India* has stood alone as the main mouthpiece of the laboratory medical research worker in India. It is however an official journal and though it neither limits its contributions to one type of article, nor its contributors to members of the services or to employees of the Indian Research Fund Association, the majority of the contributors fall into one of these categories, and there is a very natural feeling amongst independent research workers that they should have a non-official journal in which they can publish the reports on their investigations. This is the particular hiatus that the *Annals of Biochemistry and Experimental Medicine* fills, and, we will add, fills remarkably well.

The format of this new journal is excellent; it is dignified and artistic, and compares very favourably with similar medical journals of other countries. The printers are to be congratulated and so are the editors, for the matter is well arranged, and in particular one notices that a considerable degree of uniformity in the presentation of references has been achieved, and this we know from experience means a very great deal of hard work on the part of the editorial staff.

We hope that we shall not be accused of 'admiring the frame'. The frame of a picture is of minor importance; the format of a journal is another matter, for, while the contents will vary from number to number, the format usually remains constant. There are in this number some extremely important contributions to medical science, and to dietetics in particular, and if this standard is maintained the journal will certainly take an important place amongst world medical literature.

We welcome this journal particularly because we receive from time to time scientific papers that should obviously receive early publication, yet we are unable to give them the preference that they deserve at the expense of clinical papers, or papers that have a more immediate clinical application. This type of paper will now have another outlet, and we shall be saved the

embarrassment of offending the writers by refusing or delaying the publication of, quite frequently, very important papers.

We congratulate all concerned in this new enterprise and wish it every success.

### REPORT OF BOTANICAL SURVEY OF INDIA

#### BENGAL FERN AND PLANT SPECIMENS

THE Superintendent and Curator of the herbarium of the Royal Botanic Garden at Sibpur botanized in parts of Darjeeling, Midnapur and Chittagong districts on behalf of the Bengal Government and brought several hundreds of flowering plant specimens and ferns for their studies and for incorporation in the herbarium at Sibpur.

It has been found that there are suitable localities in India for the cultivation of ipecac (*Cephaelis ipecacuanha*), a widely-used vegetable drug and one of the few known remedies for dysentery. A considerable quantity of the crude drug is now imported but it is believed that, with judicious cultivation, India may make herself largely self-sufficient.

An enquiry made on the tung oil or Chinese wood oil industry in the chief centres of cultivation revealed that there are considerable possibilities for the industry in India; tung oil is used in large quantities in India but much of it is imported.

There is ample scope for the manufacture of papain in India from the milk juice of the common papaya fruit, says the report. With the world demand for it increasing, the cultivation of the plant comparatively easy, and sites with requisite conditions of climate and soil numerous, the drug at its present attractive price offers good prospects for a large scale industry.

It has been discovered that the water-chestnut—*singhara*—a good source of clean and nutritious food, is available on a large scale and can replace sago, arrowroot and similar foodstuffs which find a good market in India. There are thousands of suitable sheets of water, says the report, which might yield rich crops of *singhara* nut, with enterprise and cheap labour.

**Quinine.**—Sales from the Government of India stocks of quinine were confined to the centrally administered areas of Ajmer-Merwara and Baluchistan. The total stock of quinine was 97,071 lb. at the end of 1939-40 and the revenue realized amounted to Rs. 47,451. The stock has recently been supplemented by the purchase of a large quantity of quinine sulphate from Java for the use of the Government of India, the Provincial Governments, and some Indian States.

### MORE SUBSTITUTES FOR FOREIGN DRUGS

MORE substitutes have been discovered for drugs formerly imported from England.

One of these is nikethamide, which has now been synthesized by an Indian firm. Another (sodium tauroglycocholate) a chemical used in bacteriological work has been manufactured by a Calcutta firm, and a sample approved by a Government bacteriological laboratory.

Soap-nuts are being tried by manufacturing depots as a substitute for quillain cortex, an imported item used in the manufacture of liquor picis carbonis.

Tolu, largely used in the manufacture of syrup tolu, is now difficult to obtain and consequently experiments are being made to ascertain if tincture benzoin can replace tincture tolu, adding, if necessary, flavouring materials.

### ASCORBIC ACID TABLETS FOR THE DEFENCE FORCES' NEED

VARIOUS firms in India are trying to produce ascorbic acid tablets, which might be suitable for the defence services. Samples of two firms are being tested and it is expected that with further advice and development the firms will be able to produce the desired article in the near future.

# ABSTRACT OF THE MINUTES OF THE BENGAL COUNCIL OF MEDICAL REGISTRATION DATED 11TH FEBRUARY, 1941

1. The Council decided that after 11th February, 1941, no medical diploma granted in the Kingdom of Italy should be entered in the Register as a registrable qualification.

2. The Council decided that with effect from 1st April, 1941, the fee for registration should be raised from Rs. 15 to Rs. 20.

3. The Council resolved to recommend to Government for an amendment of section 6 of the Indian Medical Degrees Act, 1916, by insertion of the following words after the words 'United Kingdom' in the section:—

'or that he holds a degree, diploma, licence, certificate or other documents issued in contravention of section 4'.

4. The Council decided that the attention of the Government of Bengal be drawn to the recommendations made by them in 1937 for improving the curriculum of the licentiate course on the lines which correspond very closely to the standard laid down by the Indian Medical Council.

## THE FACULTY OF TROPICAL MEDICINE AND HYGIENE, BENGAL

THE following students are declared to have passed the D.T.M. Examination, session 1940-41.

### Passed

(Arranged in alphabetical order)

1. Miss Cecilia Deevana Abraham, M.B., B.S. (Delhi), Dufferin Fund Service, U. P.
2. Altaf Uddin Ahmed, M.B. (Cal.), assistant surgeon, Government of Bengal.
3. Shaikh Tamizuddin Ahmed, M.B., D.P.H. (Cal.), private practitioner.
4. Hamindra Shankar Andleigh, M.B., B.S. (Lucknow), private practitioner.
5. Monoranjan Banerjee, M.B. (Cal.), private practitioner.
6. Miss Kaniz Bano, M.B., B.S. (Punjab), Women's Medical Service, India.
7. Dwijendra Krishna Bose, M.B. (Cal.), private practitioner.
8. Prafulla Kumar Bose, L.M.P. (Burma), L.T.M. (Bengal), demonstrator, pathology department, Burma Government Medical School, Rangoon.
9. Probodh Kumar Bose, M.B. (Cal.), private practitioner.
10. Nand Lal Chitkara, M.B., B.S. (Punjab), private practitioner.
11. Miss Seemah Cohen, M.B. (Cal.), private practitioner.
12. Miss Merlyn Colledge, M.B., B.S., D.G.O. (Madras), Women's Medical Service, India.
13. Hirendra Nath Dutta, M.B., B.S. (Rangoon), private practitioner.

14. Nirmal Ganguli, M.B., D.P.H. (Cal.), private practitioner.
15. Pashu Pati Ghosal, M.B. (Cal.), private practitioner.
16. Sachipati Ghosh, L.M.F. (Bengal), sub-assistant surgeon, Government of Bengal.
17. Shyam Sundar Ghosh, M.B. (Cal.), private practitioner.
18. Arin Kumar Gupta, M.B. (Cal.), private practitioner.
19. Mohan Hatangdi, M.B., B.S. (Bombay), private practitioner.
20. Harshadrav Ishverlal Jhala, L.C.P.S., M.B., B.S. (Bombay), private practitioner.
21. Pran Nath Luthra, M.B., B.S. (Punjab), private practitioner, Awarded the 'Chuni Lal Bose' Gold Medal, 1941.
22. Chhabildas Trikamjee Mehta, M.B., B.S. (Bombay), private practitioner.
23. Sadhan Kumar Mitra, M.B. (Cal.), medical officer, Naihati Municipality.
24. Hari Narayan Mukherjee, M.B. (Cal.), private practitioner.
25. Bibhuti Bhushon Mukhopadhyaya, L.M.F. (Cal.), pathologist, Matri Seva Sadan, Calcutta.
26. Benoy Krishna Nayak, L.M.F., L.T.M. (Bengal), private practitioner.
27. Surendralal Pande, L.M.F. (Dacca), assistant medical officer, Moran Tea Estate, Assam.
28. Harendra Chandra Paul, L.M.F. (Dacca), senior assistant medical officer, Central Hospital, Labac.
29. Balajapalli Lakshmi Kanta Sastri, M.B., B.S. (Andhra), private practitioner.
30. Kailash Narain Saxena, M.B., B.S. (Lucknow), honorary clinical assistant, Thomason Hospital, Agra.
31. Daiboki Nandan Sen Gupta, M.B. (Cal.), medical officer, Nuddea Jute Mills & Co., Naihati.
32. Sudhendu Sekhar Sen Gupta, M.B. (Cal.), private practitioner.
33. Hari Prosad Sinha, M.B. (Cal.), private practitioner.

## THE ORDER OF THE HOSPITAL OF ST. JOHN OF JERUSALEM

THE King has been graciously pleased to sanction the following promotions in, and appointments to, the Venerable Order of the Hospital of St. John of Jerusalem:—

### As Commanders (Brothers)

Major-General Norman Methvan Wilson, C.I.E., O.B.E., I.M.S., M.R.C.S.

Colonel Hugh Stott, O.B.E., M.D., F.R.C.P., D.P.H., I.M.S.

### As Officers (Brothers)

Colonel William Galder Paton, I.M.S.

Lieut.-Colonel Martin Melvin Cruickshank.

### As Associate Officers (Brothers)

Colonel P. B. Bharucha, O.B.E., D.S.O., I.M.S.

## Current Topics

### Sulphathiazole in the Treatment of Gonorrhoea: A Preliminary Report

By EDGAR G. BALLENGER, M.D.

HAROLD P. McDONALD, M.D.

and

REESE C. COLEMAN, Jr., M.D.

(Abstracted from the *Southern Medical Journal*, Vol. XXXIII, September 1940, p. 911)

Our experience with sulphathiazole and sulphapyridine has been encouraging. Although sulphathiazole and

sulphapyridine are both effective against the staphylococcus, the former is decidedly the drug of choice. In addition, sulphathiazole has been shown to be of value in the treatment of infection due to *Streptococcus faecalis*, a property which in so far as we know is not common to any other sulphonamide compound. Both derivatives are capable of producing urinary concretions because of the insolubility of their acetyl derivatives. We have not encountered clinical evidence of kidney or bladder stone in the patients we have treated. However, we have seen urines which would lead us to consider the patient a likely candidate if medication were continued. As regards gastric tolerance, very few

of our patients complained of sulphathiazole, while nausea and vomiting were observed in about 20 per cent of our sulphapyridine patients. It was interesting that patients who complained of being intolerant to other sulphonamides were able to ingest sulphathiazole without difficulty. This is an important advantage of sulphathiazole over the pyridine derivatives of sulphanilamide. It should be remembered, however, that large doses have been continued for short periods only.

#### CLINICAL RESULTS

Soon after the report of Carroll and his associates of their experiences with sulphamethylthiazole in the treatment of staphylococcal infections at the 1939 meeting of the Southern Medical Association we obtained a supply of sulphathiazole. We administered this product cautiously to patients who were unable to tolerate adequate doses of sulphanilamide as well as to patients with infections which were known to be resistant.

As our investigations proceeded it was observed that nearly all patients could ingest adequate doses without toxic reactions sufficiently disturbing to cause its discontinuance.

It was observed also that gonococcal infections which had been resistant to sulphanilamide often responded promptly to sulphathiazole. Patients who had first taken sulphanilamide or sulphapyridine were almost unanimous in their praise of sulphathiazole. Its use was naturally extended to the usual genito-urinary infections. This present report, however, is limited to our experiences with the use of sulphathiazole in the treatment of gonorrhoea.

The chief trouble experienced at first was in the somewhat limited supply of sulphathiazole available. Patients who were started with it usually were dissatisfied if the supply became exhausted and other chemicals had to be employed before they were well.

Duration of the infection and previous treatment led to the following classification:

- (A) Patients who come for treatment within the first two days after the urethral discharge appeared.
- (B) Patients with acute infections who reported after the discharge had been present for longer than two days.
- (C) Patients in whom sulphanilamide was not effective.
- (D) Patients who could not tolerate sulphanilamide because of its disturbing reactions.
- (E) Patients who could not tolerate sulphapyridine.

For the patients in group A, those in whom the discharge had not been present for more than two days, 20 minims of a freshly made silver protein solution was sealed in the anterior urethra once daily for 4 days. The intake of fluids was restricted so that the argyrol could be retained in the urethra for 4 hours at each treatment. Eighty grains of sulphathiazole were given daily for the first two days. For the next two days the dose was reduced to 60 grains daily. The sulphathiazole was given after meals and at bedtime. After the fourth day, all treatment was discontinued in order to determine at once if the infection had been eradicated.

In the group treated by this plan there were five. All obtained an immediate cure. By this we mean that the discharge disappeared after the first day, and the patient was well after the fourth treatment. The usual tests for cure were made in each case and the patient carefully followed for a period of four weeks.

These results in beginning infection will be misleading unless it is borne in mind that the not generally used plan of sealing silver protein in the urethra was employed in all of them. Similar good results have followed this procedure when sulphanilamide and sulphapyridine were used. In this group of patients the chemotherapeutic advantages of sulphathiazole were not so obvious as was its better tolerance by the patients.

In group B with infections of more than two days' duration there were 40. With them routine treatment with injections and irrigations was employed to supplement the use of sulphathiazole, the dose of which was about 40 grains a day. In those without complications the discharge usually disappeared within 2 to 4 days. The last glass of urine not infrequently became clear about the third day. The first glass as a rule became clear within 6 to 7 days. Shreds often persisted for about a week, sometimes two weeks, sometimes longer. The average time required for the patients in this group without urethral strictures, prostatitis, or epididymitis was 12 days. In the group with complications the average time was 21 days.

There were 8 patients in group C without complications who failed to respond to sulphanilamide. These patients, like those in whom the acute infection had subsided before sulphathiazole was started, usually yielded with promptness. The average time required for them was 14 days.

In group D, those unable to tolerate sulphanilamide, there were 3. In none of them was sulphathiazole sufficiently disturbing to require its discontinuance and the time necessary to effect a cure averaged 12 days.

In group E, those unable to take sulphapyridine, there were 3. All were able to take adequate doses of sulphathiazole. The average duration of their treatment was 12 days.

#### REACTIONS

The toxic reactions from sulphathiazole were about like the mild ones from sulphanilamide, rarely requiring more than a reduction in the dosage.

Sulphathiazole, like sulphapyridine, has a tendency to precipitate in concentrated urine when large doses are administered. As already stated, no stone formations in the kidney or bladder have been observed by us. We have, however, taken care to reduce the dosage or increase the fluid intake when the urine became hazy with precipitated sulphathiazole.

Peripheral neuritis, which sometimes arises from sulphanilyl-sulphanilamide, sulphanilyl-dimethyl sulphanilamide and sulphamethylthiazole was not noted in any of the patients treated with sulphathiazole.

The curative effects of sulphapyridine are generally conceded to be better than sulphanilamide in gonorrhoeal infections. The chief disadvantage of sulphapyridine is its disturbing effect upon the stomach.

Our impression of sulphathiazole is that it is as effective as sulphapyridine in the treatment of gonorrhoea and far less disturbing to the patient.

Regardless of the mildness of the toxic reactions of sulphathiazole, it should be remembered that careful supervision is just as necessary during its administration as it is with other sulphonamide preparations.

#### SUMMARY

(1) Sulphathiazole was used in the treatment of 45 patients with gonorrhoea.

(2) It was observed to have fewer and less severe toxic reactions than sulphanilamide or sulphapyridine. No serious by-effect has so far been noted.

(3) It was more effective than sulphanilamide in the treatment of gonorrhoea.

(4) The doses used were about the same as those of sulphanilamide.

### Treatment of Compound Fractures in War [Reports of Practical Experience in the Spanish Civil War]

By LEO ELOESSER, M.D.

(From the *Journal of the American Medical Association*, 30th November, 1940, Vol. CXV, p. 1848)

It was evident to surgeons who took part in the late civil war in Spain that modern warfare was to differ greatly from previous wars and that the difference would be due to advances in the mechanics of transportation and especially to extensive use of aviation.

It was apparent that surgeons had much to learn and to unlearn in matters of organization, in evacuation of wounded and also in the treatment of war injuries. Especially noticeable was distrust in chemical antisepsis. Irrigations, Dakin's tubes and the complicated ritual of antisepsis that ornamented military hospitals in 1918 were unused or forgotten. Their place was taken by extensive incisions and plaster-of-paris splints. Rapid military movements and the need, after the bombing of thickly populated centres, of attending great masses of wounded called more than ever for surgical methods that were rapid and safe and that permitted of prompt evacuation with a minimum of postoperative attention. Trueta has written of these methods in his monograph on the *Treatment of War Wounds and Fractures*. The interest his manual has aroused is evidence of our concern for military preparedness.

For this reason a few further notes based on experiences gathered during the Spanish Civil War may not be amiss.

Rapidly moving warfare dominated by aviation makes simple surgical methods imperative. The necessity of concealing formations from view from the air and of moving men, wounded and supplies quickly, often under the cover of night, compels economy of materials, space and effort. Supplies and essentials are liable to be scanty or wanting entirely, either because they cannot be brought up or because they have been destroyed. Water, especially hot water, is liable to be short; liquid solutions and glass containers are liable to be spilled or broken. However, one learns to adapt oneself, and as the late Dr. Bethune wrote from China, 'I find I can get along and operate as well in a dirty Buddhist temple . . . as in a modern operating room with a thousand accessories'. The necessary economy and simplicity may by foresight and preparedness work rather to the advantage than to the disadvantage of the wounded.

#### PREPARATION

The most satisfactory easily transportable and easily procurable skin disinfectant, both for the surgeon and for the patient, is chlorinated lime.

The surgeon cleans his hands with a cream of chlorinated lime and soda worked well into the skin with a brush. If running hot water is scarce this paste is washed off by having a tiny stream of water trickle on the hands from an irrigator or a can with a spigot. Cleansing is as thorough as though a much larger stream were used. Following disinfection with lime and soda, alcohol, iodine-alcohol or a mercurial in alcohol acetone solution makes it easier to dry the hands and to put on gloves, but is not essential.

The patient is thoroughly shaved, either wet or dry, the hair being removed over the whole area which is subsequently to be encased in plaster. One applies a thick paste of chlorinated lime and soda to the skin of the operative field and removes the paste with moist gauze, working outward from the wound as a centre. This really cleans the skin of sweat, mud, dirt and grease; it may then be painted with one of the usual alcoholic antiseptic solutions, iodine or a mercurial.

Draperies should be small, so that the surgeon can keep the field under his eye and watch what unskilled assistance is doing. Large expanses of white sheeting are no guarantee of asepsis but are rather in the way. Four drapes, about a yard square clipped or sutured to the skin are enough. The skin edges are further protected by large moist gauze squares. A well constructed metal sacral rest is indispensable; improvisation of boxes and enamel basins is most unsatisfactory, but a fracture table is not essential. Two pairs of small pulleys in the form of a block and tackle arranged overhead with other pulleys fastened to the wall at the foot of the table are just as serviceable and much easier to transport than a heavy fracture table. However, a fracture apparatus such as a Depuy or Zimmer apparatus makes the placing of Kirschner or Mathews wires easier.

#### ANÆSTHESIA

Some form of anæsthesia is desirable in which the patient is not entirely unconscious but is able to co-operate to some extent. His co-operation in transportation to and from the operating room easily and saves work for stretcher-bearers, surgeons, orderlies and nurses. Soldiers at the front are notoriously easy to anæsthetize; they are usually in good physical condition, not overfed nor alcoholic and, when wounded, are often more or less on the verge of shock, so that a little morphine, a little sedation with barbiturate and a little inhalation anæsthesia go a long way toward freeing them of pain.

Thus preparation with morphine plus procaine hydrochloride infiltration around the site of injury is often all that is needed for the accomplishment of a thorough débridement and reduction of a compound fracture.

Plexus anæsthesia is very satisfactory for injuries of the upper extremity. Twenty c.c. of 1 per cent procaine hydrochloride plus two drops of 1:1,000 epinephrine are injected just above the middle of the clavicle; the needle is pointed toward the spinous process of the first dorsal vertebra. As it strikes the plexus, the patient feels a sudden tingling pain in the fingers. One should inject the full amount of procaine solution as soon as this pain is felt, moving the needle about a little to inject the various cords of the plexus. Anæsthesia follows almost immediately. If the needle misses the plexus it strikes the first rib; it should be moved about until the plexus is found. If injection is made directly squarely into the plexus but around it, anæsthesia takes from fifteen to twenty minutes to develop. The interval may be used to attend to other wounded.

For lesser injuries, injection around the site of injury is all that is needed.

A little ethyl chloride inhalation given when all in readiness is sufficient for the few minutes needed to amputate a mangled arm through the site of fracture. The man wakes up immediately, may often walk to his bed, travel seated in an ambulance, and can be given hot drinks without nausea and vomiting. It is especially important that deep general anæsthesia be not used for injuries of the upper extremity, for thoracotomy and plaster of paris is easy to apply if the man is seated but difficult or impossible if he is lying unconscious on a table.

For fractures of the lower extremity, low spinal injection of 100 mg. of procaine hydrochloride dissolved in 3 c.c. of spinal fluid injected while the man is seated with one or both legs hanging over the edge of the table produces an ideal anæsthesia. The injured man retains the use of his arms and can help balance himself on a pelvic support while plaster is being applied. Evipal or pentothal sodium injected slowly until a light narcosis is reached is satisfactory for men who are shocked or frightened. By injecting the drug slowly drop by drop, one can maintain a constant light narcotic level. Evipal, however, is not satisfactory in skull injuries with unconsciousness and delirium. It tends to increase the delirium and makes the wounded more unruly.

Ethyl chloride administered by dropping it, not spraying it, on an open face mask is a most satisfactory anæsthetic for short manoeuvres requiring good relaxation. At the moment when the patient first goes under the anæsthetic, when he takes a few deep sighing respirations, the mask should be slightly lifted to allow room for plenty of air. If this is done and sudden inhalation of highly concentrated ethyl chloride vapour is thus avoided, the anæsthetic is safe: there is no excitement stage and no struggling, which to wounded with fractures are harmful; relaxation is perfect, and consciousness returns without nausea or vomiting a few minutes after the anæsthetic has been stopped. No other inhalation agent seems to meet all requirements for short anæsthesia so well. Five minutes is to be regarded as the maximum duration of ethyl chloride anæsthesia; if more prolonged narcosis is likely to be needed, ethyl chloride should not be given or anæsthesia should be changed to ether. Bulky apparatus, inflammability and the need for ex-

anæsthetists preclude the wide use of gas in advanced hospital formations.

#### X-RAY EXAMINATION

It is seldom necessary to take an x-ray film of a compound war fracture before débridement. Inspection of the limb before operation and of the fracture during operation usually gives the needed information. Foreign bodies and the position of fragments are usually self evident in the course of a proper débridement. It is seldom necessary to take an x-ray film immediately after operation and immobilization if the operation is properly done and splints are properly applied. Radiography at the front is time consuming and cumbersome, fluoroscopy still more so.

The time and place for x-ray examination is at the evacuation hospital and farther back, at a time when fractured bone ends may have slipped or osteomyelitis and sequestration may be demonstrable.

The mobile surgical unit which I headed in Spain was equipped with a good modern portable x-ray apparatus and a dark room included in a mobile unit on wheels. They were not once used. The same was true of other advanced units which I had occasion to observe.

Conceivably radiography and fluoroscopy might be advantageous for chest wounds with suspected intrapleural foreign bodies or for abdominal wounds. It is questionable, however, whether its limited application in small advanced hospital formations calculated for rapid movement and intense activity justifies the time, weight, bulk and personnel needed for its management.

#### POSITION ON THE OPERATING TABLE

For injuries involving the front and sides of a limb, the wounded are placed on their back; if both front and back have to be dealt with, the limb is elevated or suspended so that the posterior surface is accessible. The man may also temporarily be placed on his side, but the fracture is likely to be considerably displaced in this position.

The arm may be placed on the operating table at the side of the wounded or laid across the chest; it may be held suspended from a pulley or abducted on an arm board or on a side table. It should be placed in the position in which final reduction is likely to be most easily accomplished and maintained. Draperies should not be so bulky that the fracture may be displaced by their removal; they should allow access to the arm and hand so that slings and pulls may be applied for maintenance of position while the limb is being splinted. The same consideration holds good for fractures of the lower extremity. The patient lies on his back; if the posterior surface of the limb is injured it may be placed in a Böhler frame or held suspended by slings and pulleys to allow access from underneath. In any event slings are best laid under the limb before débridement is begun so that the fracture may not be displaced later.

In amputation much blood can be saved and the tourniquet dispensed with if the limb which is to be amputated is suspended vertically upright from an overhead pulley by a clove-hitch passed around the ankle or the wrist. All its venous blood is returned to the circulation in this position, while with a tourniquet, however quickly and efficiently it may be applied, some venous stasis occurs while it is being tightened and the venous blood in the limb is lost.

#### DEBRIDEMENT

After everything is properly prepared and in readiness and not before, operation is begun; shaving should be complete, draperies adjusted with a view to their subsequent removal, slings and traction apparatus applied or laid under the limb ready for application; for it should be remembered that after débridement the soft parts and bones are to lie in the position which they are to maintain during healing. It is distressing both to the wounded and to the surgeon to see the limb jostled and moved during the application of retention apparatus, splints and bandages often to an

extent that should call for a new débridement before the plaster is finally applied. A tourniquet usually makes accurate inspection and operation easier. It should be used only if it can be rapidly and efficiently put on. It can be kept from slipping down on the limb by a towel clip through the skin or one or two sutures. A pneumatic sleeve is the best tourniquet for the arm, a wide rubber tube or an Esmarch bandage for the thigh.

Everything being in readiness, local, spinal or general anæsthesia having been induced, the skin edges are excised in the classic manner, retractors are inserted and held gently but firmly, devitalized muscle, contaminated bone chips, foreign bodies, missiles and pieces of clothing are removed. Special attention is paid to visible shreds of clothing and dirt. The position of the limb on the operating table is likely to differ greatly from that which it had when the missile struck it. Contaminated particles may be dragged up and down from a line drawn between the wound in the skin and the fracture; soft parts, muscle and fascia may have slid one over the other, occluding the tract. In order to lay all of these recesses wide open, the skin and fascia should be widely incised so that the recesses are not under tension and forcible retraction is not necessary to expose them. If forcible retraction is necessary at the time of débridement, the wound will be under tension later. Wide incisions into skin and fascia are unimportant and can be repaired perfectly; insufficient ones are very important and will determine future loss of the limb, sepsis, spreading osteomyelitis, gas gangrene and phlegmons of the soft parts. If the unimportant superficial structures of the skin and fascia are widely incised, more important deeper structures, muscle and bone, will be spared.

The wound should not be dabbed, rubbed and prodded with gauze sponges. If vessels bleed and it is necessary to use gauze in order to see them, the wound should be firmly compressed with a piece of flat gauze held in the fingers; the gauze should then be slowly rolled back until the bleeding point can be seen and caught with a hæmostat. Wiping the wound with gauze makes it bleed more and wipes dirt into its crevices.

Necrotic and contaminated muscle should be excised; severed and contaminated nerve ends may be freshened and brought together with a single fine black silk suture left long and allowed to hang out of the wound if it is thought that suppuration is inevitable, or cut short if it is thought that the wound may heal. Formal accurate perineural nerve suture is rarely indicated.

Severed vessels should be caught and tied. Arterial suture is almost never possible or permissible. A compound fracture with a cold pulseless limb calls for amputation unless exceptional vigilance is possible during the first few days after injury.

Tendons lying in a contaminated area may be allowed to remain if they can be cleaned and covered by clean viable soft parts not under tension. If they are severed, their clean freshened ends may be approximated by a single suture and similarly covered. If it is not possible to cover them they had better be allowed to retract into their sheaths, for if they remain exposed in a wound they will certainly slough. More of them will be saved for secondary suture later if they are allowed to retract.

Open and exposed joints should be similarly covered. If it is possible to sew clean synovia over them without tension, their function may be preserved, but in no case should they be covered by skin sutured under tension.

Entirely loose fragments of bone should be removed. Grossly contaminated bone ends from which the periosteum has been stripped should be removed with the rongeur until clean covered bone appears. Grossly contaminated periosteum should be removed.

If the bone ends hold their position without internal fixation, so much the better. If they tend to slip they may be held by a wire passed through drill holes if it is possible to drill the holes without stripping the periosteum and traumatizing the fracture by dislocating its ends from the wound. Oftener it may be possible to grasp the bone ends and hold them approximated



with a towel clip, which should be left in the wound. If its branches cannot be closed, the handles may be tied together with a piece of silk or twine. Only if a bone is widely exposed and will obviously sequestrate is it permissible to use metal plates, which should lie fully exposed in the surface of the wound. Their application in the depths of a wound entails needless trauma and exposure of the bone.

Whether packing should be placed about the fracture depends on the extent and duration of contamination and the completeness of débridement. More or less sequestration will almost certainly ensue if the fracture is surrounded by gauze packs. If it is possible to surround it with soft parts without tension, it may heal without suppuration.

A few sutures are permissible when it seems expedient to cover vulnerable structures—tendons, cartilage, blood vessels—which die when exposed or which it is dangerous to allow to remain so. Such sutures should be of fine 00 or 000 catgut or fine silk (if the operator is incorrigibly silky) and should not create tension. If liberating incisions cannot loosen the parts to be sutured, suture had better be withheld.

If all structures lie perfectly loose and naturally, packing may be omitted. If contamination of the fracture site is such that the wound must be left unclean, it may be better to introduce a pack of iodoform gauze or plain gauze. In any event, it seems, in the light of newer experience, that it may be wise to sprinkle the wound liberally with sulphanilamide powder.

During the whole operation, which frequently it does not take as long to perform as it does to tell about, instruments should be changed or wiped and cleaned constantly with moist gauze. This applies especially to scissor blades and the teeth of tissue forceps. The gauze should be discarded each time, and no sponge or gauze should be introduced into the wound twice. Ample incision into the skin and easy exposure will make débridement, even of extensive wounds, not too time consuming.

#### SUTURE

After each débridement the question arises 'Shall the wound be closed by suture?' The answer is usually like Thackeray's to the young man about to marry: Don't. If the pros and cons are weighed each time, the cons will so outweigh the pros that there will be little doubt what to do. The pros reduce themselves to the advantage of a small linear scar—a negligible advantage. Shortening of time of hospitalization scarcely comes into question, for even though the wound is left open and allowed to granulate it will be closed or may be closed by secondary suture or skin grafting by the time the fracture is consolidated. The cons are overwhelming, for it will rarely be possible, in spite of the promptest and most complete débridement, to assure asepsis in extensive war injuries that warrant the performance of a débridement at all. And if such wounds are closed by skin suture producing even the slightest tension, danger to life and limb is great. In the best of events, if suppuration ensues, hospitalization will be measured in terms of years instead of months. Exception may be permissible in wounds of the hand, wrist and ankle, when the danger of serious sepsis is not great, when the skin can be approximated without tension and when valuable tendons will slough unless they are covered.

The wound is covered with small dressings of sterile gauze and the limb is immobilized for evacuation. In wounds that are likely to bleed, sterile gauze is preferable to Orr's petrolatum pack; wounds covered with petrolatum ooze and bleed much longer than when covered by sterile gauze.

#### APPLICATION OF PLASTER SPLINTS

The use of plaster of paris may justify a few generalities. In surgery, as in every other art, each material calls for its own technique and what is valid for one medium may not be so for another.

In the United States plaster of paris is used on crinoline or starched gauze bandages; in Spain and

France plain unstarched gauze bandages are used. Crinoline plaster bandages have more body and are easier to apply without wrinkles; however, their starch content delays setting and makes it necessary to use rapidly setting plaster of high quality (alabaster or dental plaster) if the cast is to set reasonably quickly. The casts are probably not quite so hard but are tougher than the ones made with unstarched bandages. Plaster on plain unstarched gauze is somewhat more difficult to apply smoothly, especially for those used to starched bandages; however, it sets more quickly without the starch, so that slower plaster of inferior quality can still be used satisfactorily. The casts are harder but more brittle than those with starched bandages; they are likely to be a little thicker. In France and Spain flannel cut to a pattern and immersed in a plaster cream is occasionally used. This is especially useful for jackets, body casts and half body casts (plaster shells). It saves time and trouble when properly applied. For general use when good plaster is available the crinoline bandage is probably preferable; if plaster of a poorer grade, and ordinary commercial plaster such as can be bought at most lime kilns, is all that can be had, unstarched plain coarse mesh gauze bandages are better.

Plaster-of-paris bandages conform to the shape of the body by being moulded to it; they have no elasticity and cannot, like gauze or flannel bandages, be pulled or stretched into shape. Their cohesiveness is great; they will not work or slip or stretch. Every crease and every wrinkle in them becomes petrified when the plaster sets and will cause intolerable pressure if it overlies a bony prominence. To pad plaster with absorbent cotton or some such material is to frustrate the purpose of plaster. It will immobilize imperfectly, for the limb will work up and down in its cotton sheath; it will be more and not less likely to cause pressure sores, for it is impossible to mould it accurately to the limb if it is separated from it by an uneven surface, such as that of cotton padding; and lastly and most important the immobilization due to the plaster sticking to the underlying skin is lost, and traction against muscle pull can be secured only by pressure of the plaster splint against flaring surfaces, such as the knee, the ankle, the dorsum of the foot, the heel and the hand below the wrist, instead of being equally distributed throughout the whole limb, as when plaster is applied directly to the skin.

It is obvious that some way of holding a limb must be devised that will keep it in position while the plaster is being put on. It is equally obvious that unless the limb will hold its position by itself, which it will not often do in fractures, its position cannot be retained by the hands of an assistant, for he must let go each time a turn of bandage or a splint is to come between his hands and the patient's skin. Some form of traction is necessary which can hold its place, at least until the plaster hardens, a metal pin, a bandage or some material that can be incorporated into the splint or retain its position under it. It is obvious again that the hands of an assistant do not meet these requirements. Plaster should be applied with regard for what it can do and what is required of it, and (especially in advanced hospitals where the wounded cannot be kept under observation) with more of an eye to what the next few days, weeks and months may bring than with regard to the needs of the moment.

The limb is kept in position by suspending it or pulling on it with bandages which are greased and are incorporated into the cast but are withdrawn before the man leaves the operating table, for they will cause pressure if allowed to remain. Or at times metal pins may be convenient. The need for these will not be great if unpadded casts are used. Traction should not be too forcible if there has been much loss of osseous substance, for a wide gap between bone ends is likely to lead to nonunion. The perfect relaxation of spinal anaesthesia increases the risk of wide distraction.

Dressings should be small, just large enough to prevent plaster of paris from leaking into the open wound; they should be held in place by a few small



narrow strips of adhesive and not by a bandage encircling the limb; slings should not be too wide; as much skin as possible should be left uncovered for the plaster of paris to adhere to. Painting the area around the wound with compound tincture of benzoin will prevent acne pustules from old wound secretions and help dressings and plaster to stick to the skin.

The plaster should be applied with due regard for the stresses and strains involving both the fracture and the neighbouring joints. Lateral strips are laid on first, a few layers at a time, two or three, not more than four. The fit of the cast depends on the neatness and accuracy of these inner layers. They are moulded with the hand to the shape of the limb. Creases and folds are removed by notching the strips or removing a V shaped dart, so that the plaster lies perfectly smooth. A half dozen layers or so are laid on and allowed to set a little; reinforcements are added by using shorter strips at the site of fracture or at the joints or by laying on longer strips folded lengthwise. After these longitudinal strips are hard enough to retain their shape and not buckle or dent, they are held in place by a circular bandage one layer only in thickness; no turns or folds are made in this bandage, but it is cut across and started again as soon as it ceases to run smoothly over the longitudinal strips and the limb. Care should be taken that the layers do not accumulate at the bend of the knee and the elbow. It is just here, where pressure is most likely to be harmful, that several layers of circular bandage are likely to overlap. When additional reinforcement is thought necessary, because the man is unusually robust or heavy or because profuse drainage is likely to wet the cast at the site of fracture or because transportation is likely to be long and hard, metal material may be added, but only after the cast is dry enough to resist pressure. If metal reinforcements are added before the plaster is quite set they will dent it and cause pressure points. Cramer splints (wire ladder splints) are particularly likely to do this. The metal, if rationally applied, need be only light and thin. Strips an inch wide cut from an ordinary tin can are just right. They can be bent and moulded by hand to fit the cast accurately. If they do this they are stronger than heavier metal which cannot be accurately applied. They are firmly attached to the surface of the cast with a single layer of circular plaster bandage pulled tight. They are placed at the level of the fracture or over joints so that their width resists bending strain; i.e., two pieces at each side of the knee, three or four pieces around a fractured femur, two pieces laterally for leg fractures. If thin aluminum sheeting is at hand this is to be preferred, being pervious to the x-rays. The cast may be made thin in certain spots so that it can break, e.g., it is desirable to put a few spica turns around the hip and pelvis in high fractures of the leg, but it is not necessary to immobilize the hip. The cast should be thin at the hip so that it can break here. The ankle should be included in casts for fracture of the femur; but, if the cast is thin at the ankle, motion may be preserved.

Suspension strips and especially hitches about the wrist and ankle must be removed before the man leaves the operating room. If the cast inclines to bend or buckle at the point where it is cut for their removal, reinforcements may be added.

Finally, as long as the wounded can be constantly and carefully watched in the same hospital the circular turns may be allowed to remain; if, however, débridement and immobilization are only preparatory to prompt evacuation, before the man leaves the hospital the circular turn should be slit all the way either up the front or the back of the limb and the cast should be wrapped not too tightly with an ordinary gauze bandage. The cast will be less likely to break if it is thoroughly dry before it is slit, if it is possible to wait twenty-four hours, but it should be slit before the wounded man is evacuated, even though it is not thoroughly dry. In dubious wounds it is better not to wrap the cast but to slit it and leave it open. If

this is done there need be little fear of constriction or gangrene.

In fractures of the leg the cast is ordinarily applied with the leg lying flat on the operating table; lateral strips are first laid on, as far posteriorly as possible, they are allowed to set, and the circular bandage is then applied. If the leg lies on a rubber sheet the circular turns can be slid under it without lifting it from the table.

Fractures of the femur are put up with the man placed on a sacral rest, his shoulders supported by a box of equal height; the leg is held suspended from overhead pulleys with the knee slightly flexed; traction is made on the ankle by means of a hitch; another sling about the site of fracture keeps the femur from disking. In the absence of overhead pulleys and in a pinch the femoral sling and the sling about the knee may be held by an assistant who stands on the table, one foot at each side of the fractured femur, facing the patient's feet. He brings the slings about his neck while his back is a little bent; as he straightens up the slings are tightened and the extremity lifted. A thick cotton pad is placed over the abdomen before the plaster is applied to allow for distension.

Fractures of the arm and forearm are put in plaster with the patient seated, on a stool if possible, on the operating table if not. It is almost impossible to put on a thoracobrachial plaster splint with the man lying on his back; hence the need for avoiding ether or prolonged gas anaesthesia. The so-called airplane splint, with the shoulder abducted at 90 degrees, is never used. Such a splint, whether of metal or of plaster, works only when the man is flat on his back; when he is up or has his head raised in bed the weight of the splint causes a valgus angulation of the humerus and produces the deformity it seeks to avoid. If transportation is to be comparatively easy, the arm is put up in 45 degrees abduction or less, with the forearm at right angles to the body in the sagittal plane; the cast should include the chest, both shoulders and the arm to the wrist with a turn or two around the hand, in what is known at the Bastos position, after Bastos, formerly professor of surgery at Madrid, now prisoner in a fascist concentration camp. Care should be taken not to tighten the turns about the chest; before they are applied the man should be called on to blow his chest up. If he cannot do this the lower part of the chest should be padded. The cast may be reinforced by a stick of wood or a Cramer splint leading from the chest to the elbow. It is not easy to apply and, unless it is fairly heavy, is likely to break at the elbow, and no great matter. The weight of the forearm sticking out at right angles to the body tends to twist the whole apparatus outward in order that the arm may drop inward. The projecting forearm makes transportation somewhat awkward; the man is likely to be jostled and bumped unless he is seated, when his knees protect the forearm. If, therefore, evacuation is likely to be troublesome it may be better to let the man carry his arm at his side and his forearm across his chest in a sling. Cotton pads are put under the arm and between the forearm and the chest; the sling, arm, forearm and chest are then encircled with a few layers of plaster of paris applied circularly. This position creates an inward rotation deformity of the lower fragment, but it makes evacuation easier, particularly if the man is to lie recumbent, to walk or to stand. The rotation can be corrected later on reaching the base and a Bastos splint applied in correct position. The man should be tagged to this effect when he is evacuated. Evacuation in a 90-degree abduction splint (airplane splint) is torture to all concerned.

### A Wartime Pharmacopœia

By M. H. PAPPWORTH, M.D. (L'pool), M.R.C.P.

(Abstracted from the *Lancet*, Vol. I,  
4th January, 1941, p. 3)

At present drugs are being used regardless of difficulties in replenishing stocks. We heed not the

morrow. Most doctors appear to be unaware of the supply problems with which the chemical firms will be faced in the near future. The writer suggests the following prescriptions as suitable for present conditions:—

*Bromide mixture*

R Sodii bromidum	..	gr. 20
Liquor arsenicalis	..	℥ 3
Aqua chloroformi ad	..	℥ 1

*Carminative mixture*

R Sodii bicarbonas	..	gr. 10
Tinctura cardamomi composita	..	℥ 30
Liquor ammoniæ aromaticus (B.P.C.)	..	℥ 30
Aqua chloroformi ad	..	℥ 1

*Rapid carminative mixture*

R Spiritus ætheris	..	℥ 30
Acidum sulphuricum aromaticum (B.P.C.)	..	℥ 10
Aqua menthæ piperitæ destillata ad	..	℥ 1

*Colechicum mixture*

R Extractum coelestis liquidum	..	℥ 5
Sodii bicarbonas	..	gr. 10
Sodii salicylas	..	gr. 10
Aqua menthæ piperitæ destillata ad	..	℥ 1

*Antacid mixture*

R Kaolinum	..	gr. 15
Sodii bicarbonas	..	gr. 30
Calcii carbonas	..	gr. 20
Aqua chloroformi ad	..	℥ 1

*Expectorant mixture*

R Ammonii carbonas	..	gr. 3
Ammonii chloridum	..	gr. 10
Emulsio chloroformi (B.P.C.)	..	℥ 10
Aqua ad	..	℥ 1

*Sedative cough mixture*

R Diamorphinæ hydrochloridum	..	gr. 1/10
Tinctura chloroformi et morphinæ (B.P.C.)	..	℥ 5
Liquor atropinæ sulphatis (B.P.C.)	..	℥ 1
Aqua menthæ piperitæ destillata ad	..	℥ 1

*Rhubarb and soda mixture*

R Pulvis rhei	..	gr. 5
Sodii bicarbonas	..	gr. 10
Ammonii carbonas	..	gr. 2
Aqua menthæ piperitæ destillata ad	..	℥ 1

*Diuretic mixture for alkalinizing urine*

R Sodii citratis	..	gr. 30
Sodii bicarbonis	..	gr. 30
Aqua chloroformi ad	..	℥ 1

*Diuretic mixture for acidifying urine*

R Ammonii chloridum	..	gr. 30
Aqua chloroformi ad	..	℥ 1

This is a simple but efficacious mixture.

*Tonic mixture*

R Ferri et ammonii citras	..	gr. 10
Extractum nucis vomicæ liquidum	..	℥ 2
Infusum quassie recens ad	..	℥ 1

*Hæmatinic mixture*

R Ferri et ammonii citras	..	gr. 30
Emulsio chloroformi (B.P.C.)	..	℥ 10
Aqua ad	..	℥ 1

*Diaphoretic mixture*

R Liquor ammonii acetatis dilutis	..	℥ 2
Spiritus ætheris nitrosi	..	℥ 30
Sodii citratis	..	gr. 15
Aqua chloroformi ad	..	℥ 1

*Anti-syphilitic mixture*

R Sodii iodidum	..	gr. 10
Liquor hydrargyri perchloridi	..	℥ 30
Aqua chloroformi ad	..	℥ 1

*Analgesic mixture*

R Phenacetinum	..	āā gr. 7½
Acidum acetylsalicylicum	..	
Pulvis tragacanthæ compositus	..	
Aqua menthæ piperitæ destillata ad	..	℥ 1

*Salicylate mixture*

R Sodii salicylas	..	gr. 20
Sodii bicarbonas	..	gr. 20
Aqua chloroformi ad	..	℥ 1

*Chloral draught*

R Chloralis hydras	..	gr. 10
Sodii bromidum	..	gr. 20
Aqua chloroformi ad	..	℥ 1

*Paraldehyde draught*

R Paraldehydum	..	℥ 2
Extractum quillaiæ liquidum (B.P.C.)	..	℥ 10
Aqua cinnamomi destillata ad	..	℥ 1

## Reviews

**SURGERY OF MODERN WARFARE.**—Edited by Hamilton Bailey, F.R.C.S. Part II. Compiled by Sixty-Five Contributors. Section II—(Continued):—Wounds, Special Considerations. Section III—Wounds of the Trunk. Section IV—Wounds of the Blood Vessels. 1940. E. and S. Livingstone, Edinburgh. Pp. iv plus from 161 to 320. Illustrated. Price, 12s. 6d. Postage 6d.

The reader is referred to the review of part I in last month's number of this journal.

In the first twelve pages of part II the general treatment of the subject is concluded. Maggot therapy is given a detailed description: this original, but by no means untried, form of treatment has not been adopted much in this country where we believe it would be useful. It is advocated as a first-aid measure

where there is much destruction of tissue and where surgical treatment is likely to be delayed.

The first 'special' section is on wounds of the trunk; there are special chapters on the thorax; stomach; duodenum, liver and spleen; large intestine; rectum and buttocks; kidney; bladder; urethra; and scrotum, testicles and penis. More general chapters are on the evolution of abdominal war surgery, laparotomy; wounds, intra-abdominal procedures, complications of the small intestine, and complications. The writers include Sir John Fraser, Sir Charles Gordon-Watson, and Messrs. Gordon-Taylor, Tudor Edwards, and Kenneth Walker.

The next section is on wounds of blood vessels. In this section, the first chapter is on the tourniquet; the authors describe the various tourniquets in common use and the methods for their application; it is a

chapter that will be appreciated more by those teaching first-aid than by the experienced surgeon, but it is a useful contribution. There are two chapters on the exposure of the main arteries of the limbs, and with the next chapter, on wounds of arteries, part II finishes.

The very great importance of this valuable and opportune publication need not be stressed.

**MODERN MEDICAL THERAPY IN GENERAL PRACTICE.** Edited by David Preswick Barr, A.B., M.D., LL.D. Volume II—Infectious Diseases, Diseases of the Nervous System, Diseases of the Digestive System. 1940. The Williams and Wilkins Company, Baltimore (Md., U. S. A.). Pp. from 1201 to 2446 plus xxxix in volume II. Illustrated. Obtainable from Messrs. Baillière, Tindall and Cox, London. Price for three volumes, £9 12s. 6d.

VOLUME II of this comprehensive publication includes infectious diseases, diseases of the nervous system, and diseases of the digestive system.

Infectious diseases are subdivided into those due to bacilli, cocci, spirochaetes, rickettsiae, viruses, mycotic organisms, protozoa, and metazoa, and diseases of unknown origin.

Typhoid is given first place and as far as diet is concerned the writer is uncompromisingly in favour of the high-calorie diet. (This diet is no new fad; it has been practised continuously in many countries since it was first advocated *thirty-three* years ago. It is a funny thing that the physician in this country who will scour the advertisements for the latest sulphanilamide preparation and put it into use almost before it has passed the experimental stages will still starve his typhoid patients.) We are reminded that Robert Graves wished 'He fed fevers' to be inscribed on his tombstone.

The next subject is also an important one in this country; it is on bacillary dysentery. The impression gained is that the writer's experience has been mostly amongst cases of the milder type of dysentery, especially that of children, but nevertheless there are some very valuable suggestions contained in this section. He will not entertain bacteriophage, but considers that vaccines may have an important place in the treatment and he quotes a forgotten (or have we missed it?) experiment in prophylaxis, undertaken at the end of the last war, with a mixed bacillary dysentery vaccine, in which some millions of subjects were involved; the result was apparently very satisfactory.

The treatment of diarrhoea is given in the section on diseases of the digestive system. There is, however, no overlapping; there is a useful classification of diarrhoea which will help the physician to run through the possible causes of diarrhoea before rushing into treatment. The treatment of ulcerative colitis is given under three headings which really represent three schools of thought as to the aetiology of this condition; he then gives his own routine, which seems to us to be the soundest (on p. 2309 he advocates the *previously* described diet on p. 2395; the error is however the printers', for the diet is on p. 2295).

For the reviewer's opinion on this important and valuable publication, the reader is referred to the review of volume I in our last issue.

**A SHORT PRACTICE OF SURGERY.**—By Hamilton Bailey, F.R.C.S. (Eng.), and R. J. McNeill Love, M.S. (Lond.), F.R.C.S. (Eng.). Fifth Edition. 1941. H. K. Lewis and Company, Limited, London. Pp. viii plus 1015, with 880 illustrations of which 116 are coloured. Price, 30s.

It is not hard to understand why this book has become so popular among medical students in this country.

Within the pages of a single volume of modest size are to be found the principles of surgery described in simple, but not telegraphic, language, and illustrated by splendid pictures wherever possible. Surgery that has only historical value is omitted, and advanced surgery is given in small type.

This, the fifth edition, shows numerous alterations in order to bring the material up to date; there is even a skiagram from a soldier wounded at Dunkirk.

The student of to-day is lucky indeed to have such a beautiful book to help him with his surgery, and we have no doubt of its continued success.

W. McN. N.

**ORTHOPÆDIC OPERATIONS: INDICATIONS, TECHNIQUE AND END RESULTS.**—By Arthur Steindler, M.D., F.A.C.S. 1940. Baillière, Tindall and Cox, London. Pp. x plus 766. Illustrated. Price, 50s.

THIS book is an important addition to operative orthopædies by a well-known authority. In his preface, Professor Steindler describes it as a final account of his experience.

There is a short introductory section dealing with general principles, followed by a second section of twelve chapters on operative technique. A final section, to which 323 pages have been devoted, deals exhaustively with end results, selection of operation and operative indications. This layout is original and unusual, and, though it necessitates cross-references, is of more value to the surgeon in actual practice than more orthodox arrangements which are designed to facilitate the passing of examinations.

The writer has limited his text to the description of procedures actually used by himself. This entails some omissions, but increases the authoritative value of the work. It can be confidently recommended to all surgeons who are called upon to perform orthopædic operations.

J. C. D.

**PRINCIPLES OF HÆMATOLOGY.**—By Russell L. Haden, M.A., M.D. Second Edition. 1940. Henry Kimpton, London. Pp. 362, with 104 illustrative cases and 167 illustrations including 173 original photomicrographs and 100 original charts and drawings. Price, 21s.

THE reviewer has kept the first edition of this book close at hand since it was published two years ago, and has probably referred to it more frequently than to any other book on hæmatology; he has also used the diagrams as the basis for many of his class diagrams, and on occasions he has frankly copied the originals. The changes that have been made in the present edition are few, and would not have called for a new edition had the previous one not been exhausted; nevertheless, there are a few important additions, e.g., in connection with hæmorrhagic diseases, which bring the book up to date, and on blood typing, which tend towards making it more complete. There are still no coloured plates, but there are some really excellent photographs of blood cells which are almost as useful. The author takes the view, and we are tempted to agree with him, that the identification of the cells found in a bone-marrow smear is the job of an expert.

The author's technique strikes us as being curiously defective in places. We have recently tried very hard to use his special hæmoglobinometer and have found it neither convenient nor accurate. Accuracy is obviously not aimed at, as it only estimates to the nearest gramme.

The first edition has been the joy and despair of the reviewer for a period of over two years; the second edition is neither better nor worse, but is up to date and more complete. No teacher of medicine, pathology or physiology should be without this book, but no student, physician or laboratory worker should depend on it solely.

L. E. N.

**CEREBRO-SPINAL FEVER.**—By Denis Brinton, D.M. (Oxon.), F.R.C.P. (Lond.). 1941. E. and S. Livingstone, Edinburgh. Pp. vii plus 163. Illustrated. Price, 8s. 6d. Postage, 6d.

THE publication of books on human ailments has seldom been so timely as the publication of this little book on cerebro-spinal fever. The increased prevalence

of meningococcal meningitis and the continued unfavourable conditions that this war imposes on the people of Britain has given the disease that increased importance which it invariably assumes in war-time. This alone would be sufficient to create a demand for a small and easily-read book like this one, for the use by physicians with little practical experience of the disease, but the introduction of sulphonamide compounds in the treatment of meningitis and the numerous scattered reports of its successful therapeutic action has created a need for a small book in which the subject is briefly reviewed and the essential features of the new treatment simply stated. This the author set out to do and has succeeded.

The summaries at the end of chapters 2 and 3 are so good that one regrets that summaries to the other chapters are not available; a summary at the end of the chapter on treatment would have been useful to the practitioner.

It is unfortunate that the author considered it necessary to include the confusing and impracticable distinction between recrudescence on the one hand and relapses and second attacks on the other. A recrudescence is said to arise from a dormant *meningeal* focus waking into activity after the main infection is overcome and is to be distinguished from relapses and second attacks in which reinfection by the *nasopharyngeal* route is presumed. This distinction will remain a confusing and impracticable one until a simple method for determining whether a recurrence has originated from a nasopharyngeal or meningeal focus is evolved.

The résumé of the treatment with the sulphonamide drugs is simple and to the point. The attention drawn to the danger of administering sodium sulphapyridine intrathecally is timely. The high degree of alkalinity of this compound, equivalent to deci-normal sodium chloride, produces a tissue necrosing action with serious degenerative effects on the cauda equina. The drug rapidly reaches the cerebro-spinal fluid after administration intravenously, so that the necessity for intrathecal administration is not apparent.

This book will find a ready sale, not only in Great Britain but also in India where cerebro-spinal fever is becoming increasingly prevalent in overcrowded cities, Calcutta, Bombay, and Delhi.

**THE CHILD'S DISCOVERY OF DEATH. A STUDY IN CHILD PSYCHOLOGY.**—By Sylvia Anthony, M.A. 1940. Kegan Paul, Trench, Trubner and Company, Limited, London. Pp. xvi plus 231. Price, 11s. 6d.

As Professor J. C. Flugel observes in the introduction he has written to this book, it is high time that man was brought face to face with the psychology of death. We can afford no longer to seek satisfaction in the mass of magical belief and practice which mankind has elaborated to bolster up his refusal to accept the fact of natural death. That Mrs. Anthony had a very hard task to perform when she set out to collect data about the ideas children entertain about death, no one who reads this book can doubt. As most people realize it is very difficult by direct questions to find out about what children really do think on account of resistance children offer to certain types of questions, particularly when addressed to them by strangers. Hence in this investigation direct questions with personal implications had to be ruled out, so Mrs. Anthony had to utilize two main lines of approach, (i) to record children's spontaneous remarks, questions and behaviour, and (ii) the story-completion test. This test consists of a series of brief story-openings which the child is invited to complete, verbally. Although none of the story-openings make any reference to death, the test when first applied in Geneva resulted in no less than 66 per cent of the children making some reference to death. Mrs. Anthony's researches have led her to hold the opinion that the idea of death occurs very readily in the phantasies of

normal children. She thinks that most children are pre-occupied in 'working over' the personal emotional significances of death. She is led to suppose that a child is liable to a strong sense of guilt when a member of his family dies and the reaction thereto is either excessive excitability or sullen unsociability, although different ages will react in somewhat different ways. The child's desire not to be separated from the dead loved-one may evoke a desire to be dead too with a corresponding fear of the fulfilment of this desire. On the other hand, children may seek to allay the anxiety they may experience through phantasies about death by denying that they can die. The book is provided with a very adequate bibliography and index.

O. B-H.

**MALARIA CONTROL BY ANTI-MOSQUITO MEASURES.**—By Gordon Covell, C.I.E., M.D., D.P.H., D.T.M. & H., Lieut.-Col., I.M.S., Director, Malaria Institute of India. Thacker, Spink and Co. (1933), Ltd., Calcutta. Second Edition. 1941. Pp. xi plus 224. Illustrated. Price, Rs. 7-8

TEN years have elapsed since the first appearance of this work, and in this second edition the author has summarized the published experiences of workers during this period from all over the world, involving the collation of no less than 1,148 references, which is double the number dealt with in the first edition.

It is illuminating to re-read the unchanged letter-press of the first part of the work, and to see how many of the methods advocated ten years ago have passed into the limbo of historical curiosities. None the less, it is likely that they will from time to time re-appear as fresh 'discoveries', and so it is very useful that they should remain on record, for relegation to their correct status.

It is unfortunate that certain investigations called for in the first edition have even now not been undertaken. For instance, whilst the wire mesh aperture necessary to exclude the very small *Anopheles* of the *funestus*-group has been worked out, the mosquito netting aperture necessary for the same purpose has not been, and the standard British Army mesh (p. 1 and fig. 1) appears to be too large for safety.

The use of adult check catches, so rightly stressed in this edition, has not been standardized, either in time, in location of catching stations, or as to whether (p. 33) morning catching of resting adults or the use of traps operating all night is preferable, either for the world as a whole, or for any particular malaria vector. It is true that studies on the adult habits of individual species are only now beginning to demonstrate how varied these are, but meanwhile each particular worker pursues his own preferred method, rendering results obtained by various workers incomparable.

In very recent years work on larval biology has been rather neglected in favour of work on adult bionomics, hence no further work has been done as to whether the anti-malaria effect claimed for clover (p. 27) may not have a basis quite unenvisaged by d'Herelle, by the raising of the nitrogen content of the soil and thus of the surface water (p. 84), whilst very little more has been done on the effects of various water plants on breeding (p. 82).

The effect of Paris green on the growth of rice, which has been the cause of so much debate in this country in particular, owing to the opposition born of ignorance that the procedure engenders among villagers, is left with no further comments in this than in the first edition (pp. 69 and 89). The author certainly gives a series of new references, but this is a subject on which an authoritative pronouncement is long overdue.

The change in the author's opinion of the comparative value of *Gambusia* over all other fish (pp. 79 and 118) is very interesting, and is one with which almost all other workers will find themselves in agreement.

A few minor points on which the reviewer could wish the author had been more explicit are:

P. 38. Breeding of *A. maculatus* can take place in weep holes in pukka drains, and, in localities where this species is a vector, requires dealing with by oil swabs, a rather laborious procedure.

P. 41. Expanded metal is better than vertical rods in preventing the entrance of small animals into subsoil drains.

P. 105. The reviewer is completely at variance with the opinion that the use of special 'spreaders' with mosquito oils is unjustified. The work quoted on p. 46, in his opinion, still stands. Without the addition of 1 per cent cresol, Diesel fuel oil, so much cheaper than Malariol, can hardly be used.

P. 55. It is usually more important to know the number of linear feet of drain edge coverable by one gallon of oil discharged from the usual pressure sprayer, than the number of gallons required to treat one acre of water surface. The figure usually accepted varies from 500 to 750 feet, though Malayan workers will probably consider even the lower figure excessive.

P. 59, p. 66 (footnote). Where a very light diluent is used all the Paris green has often dropped out of the cloud, whilst the latter is still visible. Thus, if a fresh line of application is taken up from the line where the cloud disappeared, an area which is actually untreated is likely to remain. Soft stone powder has the advantage that its weight is not greatly different from that of Paris green, but there are many places, such as Italy, using road dust, where the point is of importance.

The work makes its appearance in the middle of a world war which so far has largely taken place in malarious countries. The anti-malaria officers of the armies are largely being drawn from young medical officers given some training before going on to this line of work. To such the book will be absolutely indispensable, whilst to those who have longer experience, both in civil and military, the mine of collected information comprised in the references will as before be invaluable. The author has again earned the gratitude of all workers in applied malariology.

R. S. W.

**IDEAL MARRIAGE: ITS PHYSIOLOGY AND TECHNIQUE.** By Th. H. Van de Velde, M.D. 1940. William Heinemann (Medical Books) Limited, London. Pp. xxvi plus 335. Illustrated. Price, 12s. 6d.

It is an astonishing thing, when one comes to think of it, that mankind after existing for 50,000 years on this planet, is still in need of instruction as to how and when and where he should copulate. This book is in its fourteenth impression. It has been translated into eighteen languages and is being translated into seven more, including Hindustani. It might seem that in time *Ideal Marriage* will be more widely read than the Holy Bible. Are we to deduce from these astonishing figures that at long last man is determined to prove his claim to the title *sapiens*? It looks very much as if this might be so, in which case the credit for establishing the claim will belong to this wise and cultured Dutch doctor. To any student of sexology, it should be evident that a knowledge of sex is in inverse ratio to what is ordinarily termed civilization. We do not reach full awareness of sex and all that it connotes until we are among quite primitive people. The reason for this state of affairs is by no means evident. Oriental asceticism and the teaching of St. Paul and the early Christian Fathers may account for a fraction of the prevailing ignorance of sex, but by no means all of it. Mahammed told his followers to 'go in unto your women they are as a tilth unto you'. He showed no concern about what his male followers would do when they arrived. Presumably he took it for granted that they knew what to do. If we are to believe Dr. Van Velde and there is no reason at all why the early converts to Islam were any less ignorant of how to copulate properly than 20th century Europeans and Americans.

No doctor and particularly no gynaecologist can afford to disregard this book. It were well were it included as a book for compulsory study in all colleges throughout the world. No doubt in time a chair of sexology will be recognized as essential a feature of a university as a chair of economics, or even more so. Had the author provided diagrams to chapter XI, part III, the book would be even more wonderfully interesting than it is.

## Abstracts from Reports

### BENGAL PUBLIC HEALTH REPORT FOR THE YEAR 1938

**Cholera.**—Cholera was responsible for 71,133 deaths in 1938 with a death rate of 1.4 per mille against 32,710 deaths with a death rate of 0.7 per mille in the previous year showing an increase of 100 per cent over the latter. It was also 40 per cent more than the average of the previous quinquennium (1.0). 5.4 per cent of the total provincial deaths in 1938 was due to cholera.

Cholera is usually seen at its worst in the month of April in which water scarcity is acutely felt in Bengal. But during the year under report, the disease attained its apex in November as the aftermath of the previous months' very extensive flood.

**Smallpox.**—Large scale epidemics of smallpox usually occur in a cycle showing its worst at every fourth or fifth year. Experience in Bengal in this respect has been rather different during recent years. Its course has been irregular and spasmodic rising suddenly as in 1936 with an unusual fall during the succeeding years. Nine thousand two hundred and eighty-nine persons died from smallpox in the province during 1938 against 27,944 deaths in 1937 with death rates of 0.2 and 0.6 per mille respectively. There was, therefore, 66.7 per cent decrease in smallpox mortality rate in 1938 compared with the previous year. Compared with the previous quinquennium, the rate also decreased by 50 per cent. Smallpox accounted for 0.7 per cent of

the total provincial mortality in 1938. Four hundred and sixty-one registration circles out of 712 and 2,599 villages out of 86,361 were affected with smallpox in 1938 against 470 registration circles and 5,983 villages in 1937.

**Fevers.**—Fevers took a heavier toll of lives in 1938 than the previous year.

**Sale of quinine.**—9,934.3 lb. of quinine were sold through post offices in 1938 against 8,729.8 lb. in 1937 and 6,007.3 lb. in 1936. Compared with the previous year, 14 districts showed an increase and 13 districts a decrease in the sale of quinine in 1938. While the average consumption of quinine per head from this source rose by 13.8 per cent, the fever indices rose by 5.9 per cent.

It has been estimated that for treatment of malaria cases Bengal has the capacity easily to consume 350,000 lb. of quinine every year. But during 1937-38 the amount of quinine used in Bengal was 112,353 lb. of which 51,839 lb. were locally produced and the balance of 60,514 lb. were purchased from foreign sources. The quinine factory at Mungpoo has the utmost capacity of producing 60,000 lb. of quinine per annum. The actual production of quinine at present is below the capacity of the factory (48,000 lb.) owing to deficiencies in bark supply. We may aim at the immediate production of at least 200,000 lb. and later 350,000 lb. It is essential that Bengal should strive

## Specifications of fever deaths in 1937 and 1938

Causes	Number		Death rates per mille		Percentage of increase + or decrease - in 1938	Percentage to total fever mortality	
	1937	1938	1937	1938		1937	1938
Malaria fever ..	372,992	416,521	7.5	8.3	+ 10.6	48.1	50.8
Enteric fever ..	8,978	9,808	0.18	0.20	+ 11.1	1.1	1.2
Measles ..	4,875	2,969	0.10	0.06	- 40.0	0.6	0.4
Relapsing fever (spirochaetal).	2	3	0.00004	0.0001	+ 50.0	0.0003	0.0004
Kala-azar ..	21,227	21,642	0.42	0.43	+ 2.4	2.7	2.6
Influenza ..	2,422	2,143	0.05	0.04	- 20.0	0.3	0.3
Cerebro-spinal fever ..	938	1,337	0.02	0.03	+ 50.0	0.1	0.2
Typhus fever ..	2,814	4,034	0.06	0.08	+ 33.3	0.4	0.5
Blackwater fever ..	229	212	0.004	0.004	± 0	0.03	0.03
Other fevers ..	361,109	361,094	7.2	7.2	± 0	46.5	44.1

to increase her quinine output so that the provincial demand could be adequately met.

**Dysentery and diarrhoea.**—The total number of deaths reported from dysentery and diarrhoea in 1938 was 69,232 with a death rate of 1.4 per mille against 56,800 with the death rate of 1.1 per mille in 1937. The death rate increased by 27.3 per cent both against the last year's rate and that of the last quinquennial average. Thirty-six thousand one hundred and twenty-six males and 33,106 females died from these causes during the year under report. Taken separately, dysentery accounted for 37,966 and diarrhoea 31,266 deaths in 1938 against 31,289 and 25,511 deaths, respectively, in 1937, the ratios being 0.8 and 0.6 per mille against 0.6 and 0.5 respectively, in 1937. Dysentery and diarrhoea accounted for 5.3 per cent of the total provincial mortality in 1938 against 4.6 per cent in 1937.

**Pneumonia.**—After a temporary halt in 1937 pneumonia resumed its onward march in 1938, which commenced in 1923. The increase in deaths from this disease in the rural areas has been kept up ever since without any drop. During the year under report there was a slight reduction in deaths from this cause in the urban areas but in the rural areas and in Calcutta, the mortality was higher than in the previous year. In the province, the increase was by 7.1 per cent—in Calcutta by 3.2, in the rural areas by 8.7 per cent, while in the urban areas the decrease was by 5.7 per cent.

**Pulmonary tuberculosis.**—There was striking identity in the total number of deaths from pulmonary tuberculosis during 1937 and 1938, the figure being 14,668 in both the years with the same death rate of 0.29 per mille, although variations occurred under the heads making up the total. In the rural areas, the slight decrease in the total number did not disturb the last year's rate, but in the urban areas the death rate increased merely by 2.3 per cent. In Calcutta also, the slight increase in the death rate was equivalent to 1.1 per cent. Of the total number of deaths in the urban areas Calcutta alone was responsible for 68.4 per cent.

#### ANNUAL REPORT OF THE PUBLIC HEALTH DEPARTMENT IN THE CENTRAL PROVINCES AND BERAR FOR THE YEAR 1939

The year 1939 was less unhealthy than the average and was appreciably better for the public health than the preceding year. The death rate fell from 37.57 per mille in 1938 to 31.07 in 1939 owing to a large drop in cholera cases and reduction of mortality under all heads except smallpox and plague. The urban death rate was almost the same as the rural death rate. Infant mortality showed some improvement over the last year's rate especially in the urban area. The birth rate was slightly less than in 1938. The comparative figures of the death rate, especially infant mortality, in

this and other provinces constitute a challenge to increase the effort to better the conditions affecting public health in this province. While the province has the third highest birth rate in India, it has the highest death and infant mortality rates. Government hopes that with the reorganization and expansion of the public health department by the appointment of a sub-assistant health officer in each tahsil it will be possible to effect substantial improvement in the whole of the province.

As compared with 1938, the year 1939 showed a decrease in deaths recorded from all diseases except plague and smallpox. The death rate from cholera (0.10 per mille) showed a welcome decrease over the previous year's figure (2.71 per mille) which was the result of a serious epidemic. There were 1,661 deaths compared with 45,332 in the preceding year. It is significant that rural areas suffered from the epidemic more than the urban areas, mainly owing to the unsatisfactory nature of water-supply in the province. This emphasizes the urgency of the need for improving the sources of water-supply on which the rural population depends. A sum of Rs. 2 lacs out of the Government of India grant of Rs. 6 lacs for rural reconstruction made in 1936-37 has been earmarked for improvement of rural water-supply, but Government regrets to observe that so far insufficient advantage has been taken of this offer. The main cause of the slow progress is the lack of the prescribed local contribution.

As usual, malaria took a heavy toll of life, the mortality attributed to this disease being as much as 54 per cent of the total mortality from all causes. The only defensive weapons against this disease at present are cinchona and its products and every effort was made to increase the supply and free issue. Government had reduced the sale price of the drug but is now handicapped by the increase in prices occasioned by war conditions.

Smallpox was prevalent in a mild form in all districts except Bhandara. The Vaccination Act was extended to sixty-one villages in the Chanda district and the entire rural area of the Amraoti district, but Government regrets to note that there is still considerable apathy and sometimes even opposition to the extension of compulsory vaccination in spite of its efficacy in combating the disease. Government also considers that at least one re-vaccination should be given to all children, although under the present law this is not compulsory.

Mortality from plague slightly increased, indicating that the comparative freedom of many districts from this disease for some years past may have bred a false sense of security. Certain municipalities have even suspended anti-rat campaigns on the withdrawal of the Government grant-in-aid for the purpose. It is needless to observe that sustained effort is necessary if the possibility of recurrence of the disease is to be entirely ruled out. The number of deaths was 852, compared with 535 deaths of last year.



Leprosy is widely prevalent in the province, particularly in the Bilaspur, Raipur, Drug, Chanda, Wardha and Chhindwara districts and in Berar, and the number of deaths from this disease increased to 1,804 (1,579). The number of persons found to be suffering from the disease was 117,577, 1,181 persons having been found to be newly infected. Attendance for treatment increased from 87,599 to 117,577; 112 cases were discharged symptom-free and 2,459 were recorded as improved. These figures sufficiently indicate the magnitude of the problem presented by this disease which increasing knowledge shows to be even more prevalent in this province than was apprehended. During the year the campaign against the disease was intensified. Four additional leprosy centres and seven sub-centres were opened, making a total of 41 and 58, respectively. Five 'leprosy district councils' were established as an experimental measure in the Amraoti, Chanda, Wardha, Buldana and Yeotmal districts, and a scheme for training all sub-assistant health officers on epidemic duty in leprosy survey, propaganda and treatment work, by opening classes under the leprosy specialist at Raipur was initiated. Government would like to pay its grateful tribute to the Mission to Lepers for the shelter, care and treatment given by them in their settlements in which no fewer than 2,155 lepers and 191 healthy children are given a home.

The mortality from pulmonary tuberculosis fell from 0.11 per thousand in the previous year to 0.07. The four tuberculosis clinics, one each at Nagpur, Jubbulpore, Amraoti and Raipur, are carrying on useful work. In response to Her Excellency the Marchioness of Linlithgow's appeal a provincial tuberculosis association was formed during the year and has been affiliated to the central association. The association is at present planning its campaign for anti-tuberculosis work in the province.

The mortality among infants under one year of age was 138,806 (157,634) or 218.62 (238.20) per thousand births, against a quinquennial average of 233.76.

The main causes of infant mortality are prematurity, inanition, malnutrition (chiefly owing to want of mother's milk), diarrhoea (due to faulty and dirty feeding), respiratory causes, and 'fevers'. Smallpox caused 241 (145) deaths among children under one year.

Government regrets to note that in spite of the increasing popularity of child welfare centres as shown by the all-round larger attendance at the existing centres there was no increase in the total number of centres. With the highest infant mortality in the country in this province no area can afford to neglect the welfare of infants and there is wide scope for local bodies and philanthropic persons to take up this vitally important work, especially in the rural areas.

Noteworthy among the activities of the department during the year were the introduction of a motor travelling dispensary at Nagpur which caters for the needs of the population with a radius of 20 miles and gives every promise of success, the increase in the number of epidemic dispensaries from 43 to 68 and the opening of 14 travelling dispensaries out of the Government of India grant for rural reconstruction.

## REPORT ON THE STATE OF PUBLIC HEALTH IN BURMA DURING 1939

**Birth rate.**—This year's birth rate is 35.34. It is the highest since 1918. Compared with the five-year mean it shows an improvement of 2.01. Male births exceed female births in all but five districts.

**Death rate.**—The current year's death rate 25.09 shows a fall of 0.64 compared with the previous year but it is in excess of the five-year mean by 2.41. Decreases in mortality were noticed under plague, respiratory diseases, injuries and smallpox, while increases were noticed under fevers, cholera and dysentery and diarrhoea.

### PRINCIPAL DISEASES

The major epidemic diseases in Burma are cholera, plague and smallpox. These diseases are notifiable

both in rural and urban areas. The responsibility for taking preventive measures rests upon the local bodies concerned.

**Cholera.**—The death rate from cholera, viz, 0.12 is higher than the previous year by 0.07 but it is below the five-year mean by 0.09. Though there was the usual rise in the incidence of the disease from April to July, it was in the month of December that the highest number of deaths was recorded. The Irrawaddy and the Pegu divisions were most affected. During the year, especially in the months of October, November and December, 23,468 anti-cholera inoculations were performed.

**Plague.**—The death rate from plague is 0.27. This figure is an improvement over the last year by 0.11 but is above the five-year mean by 0.07. Out of 3,266 deaths from plague reported during the year 2,282 were in rural areas.

**Smallpox.**—The total number of deaths recorded from smallpox is only 125 and the rate 0.01 is the lowest since 1872, the first year from which figures are available. Six per cent of the deaths in 1939 were among children under one year and 15 per cent among children between one and ten years. There was no marked seasonal variation in the incidence of the disease.

**Enteric fever.**—Though this disease is notifiable in all urban areas there is no true record of its incidence. Apart from admissions to hospitals the number of cases reported by private medical practitioners are few. Even in these, the diagnosis is more often based on clinical symptoms than on bacteriological investigation. The mortality figures also cannot be taken as accurate as the medical registrar has in most cases to rely on the history given by the relatives of dead persons and on the examination of dead bodies. During the year 383 deaths were recorded in towns from this cause and the rate of 0.27 is less than the previous year by 0.05. Very high rates have been recorded in the towns of Allanmyo 1.52, Taunggyi 1.16, Yandoon 1.01 and Zigon 0.94.

**Dysentery and diarrhoea.**—This group of diseases accounted for 6,431 deaths and the death rate 0.53 is the same as last year. The highest mortality was, as usual, recorded in the month of July but the lowest was recorded this year in the month of February.

**Respiratory diseases.**—The total number of deaths returned under this head is 13,292. The provincial rate 1.10 shows an improvement of 0.08 compared with the previous year and 0.01 compared with the five-year mean. The rate for rural areas is 0.28 and that for towns is 7.29. It will thus be seen that the urban rate is 26 times that of rural. It is probable that poor housing conditions in towns are more favourable to the spread of these diseases than in rural areas, where the people lead a more out-door life. The number of deaths recorded in towns under this head is 10,300. Of these, 4,461 are ascribed to pneumonia, 2,520 to pulmonary tuberculosis, 6 to whooping cough and balance to other respiratory diseases.

**Beri-beri.**—The disease was prevalent in certain districts resulting in a fair number of deaths in some areas. In the urban areas 243 deaths were reported from this cause and the death rate of 0.17 shows an improvement of 0.16 compared with the previous year.

**Malaria.**—This disease forms one of the most widely prevalent diseases in this country and is responsible for a great deal of incapacitation and economic loss especially in the rural areas. It is, however, difficult to gauge its exact degree of incidence, as the registration of deaths is carried out by village headmen who are apt to include all fatal cases of malaria under 'fevers'. Nevertheless, spleen census taken in various parts of the province and the increasing number of malaria surveys undertaken by the Malaria Bureau have given a fair idea as to the areas in which the disease is endemic.

This year 39.82 per cent of the total mortality was due to fevers. If half the fever deaths in rural areas be taken to be due to malaria, it is seen that approximately 60,600 people died from this disease in Burma during the year under report.

**Leprosy.**—The number of deaths ascribed to leprosy in towns during 1939 is 365, the rate being 0.26. The largest number of deaths have been recorded in Rangoon and Mandalay. The presence of leper asylums in these towns, which attract lepers from all adjoining districts no doubt accounts for the greater mortality.

Colonies for housing, isolation and treatment of lepers continued to flourish at Mōnywa, Minbu, Meiktila, Sale, Magwe, Shwebo and Nyaunglun. In the Federated Shan States nine colonies were run by the American Baptist Mission and two by the Roman Catholic Mission. A new colony was started during the year at Saththadaw village in Insein district and proposals are on foot for establishing colonies at Bhamo, Thayetmyo, Nyaung-U, Thatōn, Pakōkku and Henzada. Many of the colonies have clinics attached to them in which leper patients both indoor and outdoor are treated by specially trained doctors on specified days every week.

This department took action during the year to implement the recommendations made by Dr. J. Lowe in his report. Two nominees of the executive committee of the Burma Tuberculosis and Leprosy Relief Association, two nominees of the British Empire Leprosy Relief Association, Burma Council, and two nominees of Government, viz, the Inspector-General of Civil Hospitals, Burma, and the Director of Public Health, Burma, who constituted the *ad hoc* committee to study Dr. Lowe's Report have been constituted into a permanent Leprosy Advisory Board with the Special Leprosy Officer, Burma, as its honorary secretary to act as a consultative body on the subject of leprosy. Arrangements have been made for the further study of the problem of leprosy in Burma by carrying out four limited but intensive surveys in upper, middle and lower Burma and the Tenasserim area. The other recommendations contained in Dr. Lowe's Report, such as the entertainment of whole-time Superintendents for the three leper colonies at Mōnywa, Shwebo and Meiktila, the amendment of rules under the Burma Village Act to allow segregation of lepers within villages and others are under correspondence with Government.

**Tuberculosis.**—Deaths from tuberculosis are recorded only in towns, while in rural areas they are classified under deaths from respiratory diseases. Out of 2,766 deaths from tuberculosis recorded in towns 2,520 were ascribed to pulmonary tuberculosis, 14 to tuberculosis of joints and the rest to other tuberculous diseases. The death rate from pulmonary tuberculosis is 1.78. This rate shows a drop of 0.17 compared with the previous year but is in excess of the five-year mean by 0.06.

Professor S. Lyle Cummins, C.B., C.M.G., LL.D., who came to Burma to advise the Burma Tuberculosis and Leprosy Relief Association on the measures necessary to control tuberculosis in Burma, spent six weeks in Rangoon studying the conditions in the city and its environments, visiting hospitals and performing tuberculin tests on school children and others. In the subsequent six weeks he inspected important places in Burma such as Mandalay, Shwebo, Kyaukse, Maymyo, Myingyan, Thayetmyo, Akyab, Moulmein, Bassein and Prome, studying housing conditions in each place, performing tuberculin tests and judging the suitability of sites for sanatoria. He has furnished the Association a very valuable report, recording his impressions and suggesting the lines of action to be taken. As a result of tuberculin tests made on over 9,000 people Dr. Cummins remarks that the incidence of infection is very low in Upper Burma, low in Lower Burma and that only in Rangoon its incidence is high. In Rangoon though the exposure to infection is as high as in England, the deaths are about four times as high, which would indicate that the people here are far from being as well able to resist the infection as the people in England. The mode of infection is chiefly respiratory. Housing conditions are such as to favour the spread of infection. The great need is for somewhere to place persons suffering from tuberculosis.

An *ad hoc* committee of the Burma Tuberculosis and Leprosy Relief Association considered Professor Cummins' Report and on its recommendation the Executive Committee of the Association has decided to make an offer of Rs. 2½ lacs to Government towards the construction of a tuberculosis hospital in or near Rangoon requesting Government to share the rest of the cost of construction and charges for equipment, maintenance, etc., with the Corporation of Rangoon.

**Yaws.**—Reports from districts reveal that campaigns for the treatment of yaws have been initiated by the Medical Department in a number of places. In the Upper Chindwin district the total number of cases treated since the commencement of the campaign was 10,210. In the Lower Chindwin district, a special sub-assistant surgeon was posted to Kani township for this duty. Treatment campaigns were also carried out in Mandalay and Tavoy districts by a special sub-assistant surgeon posted to each of these districts.

**Goitre.**—This disease is widespread in certain parts of the Northern Shan States. Kachins and Palaungs suffer severely. In some villages everyone has an enlarged thyroid gland. Towards the end of the year the Government of Burma deputed Captain R. L. Raymond, I.M.S., to conduct a survey of the incidence of goitre in the Chin Hills district, to investigate the causes of the disease and to report on the medical needs of the district. Two sub-assistant surgeons of this department were deputed to assist this officer in the survey. The Inspector-General of Civil Hospitals, Burma, has addressed the civil surgeons in nine districts, where goitre is known to be prevalent, to commence treating all school children by giving them half a grain of potassium iodide in solution twice a month. The medical officers in charge of the hospitals in the above districts were advised to carry out a census of the children attending schools in their areas to estimate the incidence of goitre and the civil surgeons were requested to enlist the co-operation of the administrative and educational authorities in bringing the scheme into operation.

#### REPORT OF THE DIRECTOR OF PUBLIC HEALTH, MADRAS, FOR THE YEAR 1939

THE total mortality rate in the year was 25.26 compared with the average of 24.12 for the five years ending 1938. Both the urban and rural mortality increased. The number of infantile deaths accounted for 26.8 per cent of the total mortality, the total urban and rural infantile mortality being 179.69 and 175.08 per thousand respectively.

The mortality from cholera, viz, 2,115 deaths in the year, was the lowest on record during the past 58 years. It is observed that out of these 2,115 deaths, the districts of South Arcot and Tanjore alone accounted for 854 and 806, respectively, the municipalities of Kumbakonam and Mayavaram alone in the Tanjore district accounting each for 27 and 21, respectively, against a total of 67 in nine municipalities. The report on the investigation of the high rate of mortality in these districts is awaited from the Director of Public Health.

The number of deaths from plague registered during the year, viz, 324, was the lowest on record since 1898. Only five municipalities were affected recording in all seven deaths. The remarkable reduction in the incidence of the infection generally in the province is ascribed to cyanogas fumigation. The plague research work, which had been conducted under the auspices of the Indian Research Fund Association, was taken over by the Government; contributions were made by the association, the Government of Travancore and the Madras District Board.

The mortality from small-pox showed a large increase from 2,273 in 1938, to 3,120 during the year, the number of deaths from the disease in the Chingleput district alone being as high as 838.

'Fevers' were responsible for 28 per cent of the total mortality. 'Other causes of deaths' again included 52 per cent of the total mortality. It is

unfortunate that there should be so much inexactitude in the recording; but there is at present no practicable means of avoiding it. Respiratory diseases were responsible for 21 per cent of the total deaths in municipalities giving a mortality rate of 6.81 as against 2.12 in rural areas. If the basis of classification is uniform this indicates the favourable conditions for the spread of respiratory diseases in big towns.

Anti-malaria work was continued in a few places, where there were reasons for special efforts. Anti-mosquito campaigns were organized in several municipal towns and *panchayats* and the results are reported to be satisfactory.

The health unit at Poonamallee continued its useful activities. The department maintained the progress achieved in health propaganda, rural sanitation, vaccination and maternity and child-welfare work. The percentages of cases that received skilled aid at child-births in rural and urban areas were 5.43 and 38.77, respectively. But the recorded maternal mortality rate per 1,000 births in those areas was as high as 12.13 against 8.63 in rural areas.

### *Maternity and Child Welfare*

Maternity and child-welfare work in this province progressed steadily during the year.

One hundred and thirty-six thousand five hundred and thirty-two mothers, 105,679 ante-natal cases, 60,783 labour cases, 36,571 infants and 22,997 pre-school children came under the care of the maternity and child-welfare staff. Fourteen thousand two hundred and fifty-six clinics were held at which the attendance was 123,947 ante-natal cases, 133,900 infants, 111,266 pre-school children and 87,125 nursing mothers. Women medical officers, health visitors and midwives paid 57,493, 115,014 and 917,617 home visits respectively. Health talks were given in 821 girls' schools at which the total audience was 48,433.

From January to December 1939, four batches of rural medical practitioners, aggregating 115 have been trained in public health work and many of them have been entrusted with public health work.

The execution of the water-supply schemes for Arkonam and for Manapparai was completed and the schemes were brought into operation during the year under review. The number of towns, municipal and *panchayat*, having a protected water-supply was 45 as against 43 in the previous year. Thirty-two water-supply schemes, including extensions and improvements to existing schemes, were under execution during the year.

### ANNUAL REPORT OF THE RAMAKRISHNA MATH CHARITABLE DISPENSARY, BRODIES ROAD, MYLAPORE, MADRAS, FOR THE YEAR 1940

Among the centres of the Ramakrishna Mission, the Math at Madras, now in existence for over 40 years, is a very influential one. As a side-activity of the Math the dispensary sprang up fifteen years ago. It was started in 1925 when Rao Sahib Dr. B. Raghavendra Rao, Retired Civil Surgeon of Madras, placed his voluntary service at the disposal of the institution, and undertook to meet the then recurring expenditure required for the work.

During the first year of its existence the total number of patients treated was only 970 whereas in the year 1940 the number was 61,543, which clearly shows that there has been rapid progress in its service.

Till recently there was only the allopathic department conducted on up-to-date lines. The homeopathic department was started three years ago.

Like all other philanthropic activities of the Mission the dispensary also is run mainly by private financial support. Due to general depression door-to-door collection, which has always been unstable, has now become very insubstantial. It is a pity that the institution may be compelled to limit the range of service to the poor under the circumstances. We are

glad, however, to mention a generous donation received this year from Sri M. V. Ramaswamy Mudaliar of a sum of Rs. 2,000 for the permanent fund.

The immediate needs of this institution are (a) a permanent endowment fund procuring a monthly income of at least Rs. 350 for the maintenance of the dispensary. (This amount is required for the purchase of medicines, bandages, doctor's allowance, salary of a paid clerk and an attendant boy and the bare expenses of four workers.)

(b) Suitable donations in kind or cash making available for the dispensary up-to-date medical appliances and necessary outfits for the surgical, pathological, medical, radiological and ear, nose and throat departments.

We appeal to the generous public to continue their active sympathy and co-operation, and to come forward with liberal contributions for fulfilling the immediate needs of the institution. Donors wishing to perpetuate the memory of their friends or relatives may do so by creating memorial endowments for the maintenance of the charitable dispensary. A tablet bearing the names of the persons whose memory is to be perpetuated will be fixed in a suitable part of the building. Contributions, however small, will be thankfully received and acknowledged by Swami Saswatananda, President, Sri Ramakrishna Math and Mission, Mylapore, Madras.

### THE RAMAKRISHNA MISSION SEVASHRAM (CHARITABLE HOSPITAL), RANGOON: REPORT FOR 1940

THIS report is particularly concerned with the activities of the Rangoon Sevashram which is the premier medical institution of the Ramakrishna Mission.

Started in 1921 on a humble scale in response to a local demand, the Ramakrishna Mission Hospital has steadily grown in importance and usefulness until to-day it occupies a unique position among the medical institutions of Burma. Just after the great war, the authorities, apprehending an epidemic of influenza in Rangoon, put up a few temporary cottages on a marshy plot of land in East Rangoon which was then an undeveloped area. Fortunately, there was no epidemic and these cottages formed the nucleus of the present hospital. In 1921, the Government allowed the use of the land and the corporation the use of the cottages as a hospital on certain conditions. In 1926, the Government, in recognition of the valuable service rendered by this institution, gave an assurance of 'undisturbed occupation' of the site. In 1938, the main portion of the site, just sufficient for a permanent hospital of 300 beds, was demarcated and a general plan for the future development of the hospital was approved by the Government. Recently, the Corporation of Rangoon has also transferred to the Mission by a Deed of Gift all temporary cottages which had been previously erected by the corporation. These concessions gave the hospital a permanent status. The management of the hospital conveys its sincere thanks to the Government and the corporation for their sympathy and help and the tangible form in which they have expressed their trust and confidence in the Ramakrishna Mission and its ideals.

*Indoor department.*—The year closed with 200 beds for indoor patients. Of these, 34 beds were for women and children and 22 for maternity cases. The rest were divided into different sections of the male wards. In the male wards, besides surgical and medical sections, the hospital has provision for special departments for eye, venereal and pulmonary tuberculosis cases. The total number of indoor patients treated during the year was 6,681 against 5,263 in the previous year.

*Outdoor department.*—The outdoor department is very popular as will be evident from the number of attendance. The daily average attendance at the outdoor section was 1,025 in 1940 against 833 in the previous year.

# ANNUAL REPORT OF THE HAFKINE INSTITUTE, PAREL, BOMBAY, FOR 1939. BY LIEUT.-COLONEL S. S. SOKHEY, I.M.S., DIRECTOR

THE year under review did not see any radical changes in the organization or in the activities of the institute. As in previous years the institute produced large quantities of plague prophylactic and other vaccines and carried out diagnostic work for hospitals and private practitioners. The quantities of vaccines produced were:—Haffkine plague vaccine 2,887,527 c.cm., cholera vaccine 404,798 c.cm., typhoid vaccine 17,207 c.cm., and anti-rabic vaccine, 5 per cent suspension, 733,805 c.cm. Research activities of the institute were aided by a grant of Rs. 50,000 from the Indian Research Fund Association. Lady Tata Memorial Trust gave two scholarships for research work at the institute.

**Chemotherapy of plague.**—Researches into the chemotherapy of plague have yielded very important results and beget the hope that an effective remedy for bubonic plague is within sight. During the year syntheses of new sulphonamide compounds were undertaken at the institute by a research chemist endowed by the Lady Tata Memorial Trust. Of the 35 compounds prepared six were tested for their action on mice which had been experimentally infected with plague. One of these, sulphathiazole, the synthesis of which had also been reported by the workers abroad, was found to show a very remarkable power to cure plague. When given in adequate dosage this drug was found to save 80 to 90 per cent of the plague-infected mice, which have a mortality of 100 per cent if they are not treated. Another well known sulphonamide compound, sulphapyridine (M. & B. 693), was tested at the same time and it was found that it also had considerable curative action but only if it was given very early in the course of the disease. If the administration of this drug was delayed until 72 hours after the induction of infection, it saved no more than 10 per cent of the infected mice, while sulphathiazole still saved 80 per cent. Thus in animal experiments sulphathiazole proved to be superior to sulphapyridine (M. & B. 693).

At the time of writing the results are also available of a field trial on human cases carried out at Bettiah, Bihar, with the co-operation of the Bettiah Raj. During this trial Haffkine Institute anti-plague serum, sulphapyridine and sulphathiazole were tested for their curative action in plague. No selection of cases was made for a particular kind of treatment, admissions in rotation were given different treatments. But because the different treatments were brought into use at different stages of the field trial the number of patients in each group did not work out to be equal. Two hundred and thirty-seven cases were dealt with as follows:—

## All cases of bubonic plague treated

Treatment	Number of cases	Deaths	Case mortality, per cent
Anti-plague serum ..	70	20	28.5
Sulphapyridine ..	53	13	24.5
Sulphathiazole ..	32	5	15.6
Controls—treated with iodine solution intravenously.	82	43	52.4
TOTAL ..	237	81	..

During the field trials it was noticed that the most important single factor which decided the issue in human plague was the development of septicæmia. If the lymph glands prevented the spread of the infection to the blood stream and the infection remained

localized spontaneous recovery usually resulted. On the other hand, if the organisms passed the lymph glands and septicæmia resulted death invariably followed unless an effective curative agent was given to control the infection. Therefore, a truer picture of the results is presented if only those cases are considered in which septicæmia was present at the time the treatment was started.

## Plague cases with plague septicæmia at the commencement of the treatment

Treatment	Number of cases	Deaths	Case mortality, per cent
Anti-plague serum ..	33	20	60.6
Sulphapyridine ..	30	13	43.3
Sulphathiazole ..	12	5	41.8
Usual hospital iodine treatment (controls).	40	38	95.0
TOTAL ..	115	76	..

Synthetic organic chemistry has during recent years yielded compounds of the greatest value to medicine. It is certain that this particular branch of research is destined to become even more important in the near future, particularly the chemotherapy of bacterial diseases. There is a great deal of chemical talent available in India, but chemists working in isolation by themselves cannot achieve much. For worthwhile work intimate collaboration of chemists, bacteriologists and pharmacologists is essential. The institute is admirably suited as a centre for such collaboration. It would be a great gain if a permanent department of chemotherapy is organized at the institute.

**Plague vaccine.**—The study of physical conditions, the temperature of incubation and the duration of incubation under which the most effective plague vaccine can be produced, was continued. It was found that the specific immunogenic portions of the plague organism go into solution when the organism is grown in broth or when agar growths are suspended in water. It seems that the rejection of the bacterial debris from both the broth-grown vaccines and the agar-grown vaccines would yield decidedly less toxic but equally effective vaccines.

**Serology of plague.**—Carefully conducted agglutination and agglutination-absorption tests failed to show any serological difference between the various local strains of *P. pestis* studied. No serological difference was detected even between the virulent and avirulent forms of the organism.

**Epidemiology of plague.**—From 1931 to 1936, a steady reduction in the susceptibility to plague infection of Bombay rats (*Rattus rattus*) was observed. The mortality resulting from the standard infective dose declined from 9.3 per cent to 0.0 per cent. During the same period the number of plague infected rats found in Bombay during the routine examination of about 200,000 rats yearly, declined from 748 to 0. Since 1936 no plague infected rats have been found in the city. Because of the large number of rats examined it may be taken that plague epizootic among rats in the city has entirely come to an end. It is interesting to observe that the susceptibility to plague infection of the house rat in the city has begun to increase, as indicated by the increase in mortality from standard plague infective dose from 0.0 per cent in 1936 to 10.0 per cent in 1939. These observations indicate that with the dying out of the epizootic the susceptible strains of rats have begun to multiply again. This fact coupled with the other tendency observed that a highly susceptible species, *Genomys varius*, is gradually invading the city, and is now forming something like 40 per cent of the rat population indicates that the

position of the city as regards the possible recrudescence of plague is deteriorating.

**Pharmacology.**—The nature of the destruction of plasmoquine by the body tissues was investigated further and it was shown that the agents responsible for its destruction were probably enzymes and the organs chiefly concerned in order of their activity were, brain, liver, spleen, testis and kidney. The destructive product was isolated and its pharmacology was studied. Researches into the action of atebirin in monkey malaria showed that the drug did not act directly on the parasites but through the mediation of reticulo-endothelial cells. It was also observed that plasmoquine stimulated the oxygen uptake of body tissues.

During the year there was an increased demand for the services of this department for the biological assay of drugs. This work the department cannot very well undertake as it is a purely research department maintained by the Indian Research Fund Association. Further, as legislation was recently passed to control the preparation and the sale of drugs, the province will have to establish a Pharmacological Department to carry out this control effectively. Such a department can be organized most effectively at the institute because of the facilities already existing there.

Besides carrying out analyses for testing the purity and strength of drugs for control work, the new department will discharge another even more valuable function. Strict control of the manufacture and sale of drugs will give an impetus to the production of drugs in the province itself. At the start, and perhaps for some considerable time to come, the manufacturing firms will not be able to afford highly developed scientific departments of their own for final exact testing of the products. This aid the institute can provide quite inexpensively. The department will thus by testing and advice promote the development of the industry.

**Biochemistry.**—Besides the routine diagnostic work for hospitals and private practitioners, the department continued its studies of the blood urea clearance test. One hundred normal Indian male subjects were examined. The average values obtained were 44 c.cm. for maximum clearance and 34 c.cm. for standard clearance. The corresponding averages for Americans were 75 c.cm. and 54 c.cm. respectively. This is a most useful set of observations for clinical work. McIntosh and van Slyke's blood urea clearance test is now very commonly used in India for determining renal efficiency in diseased conditions and if the American figures are relied upon the results obtained would be very misleading.

The department has also been working to prepare basal metabolic standards for use in India. This was made imperative by the studies carried out in the department which showed that the B.M.R. for Indians was lower than that for Americans by about 8 per cent. The use of American standards for evaluating B.M.R. for Indians was consequently misleading.

**Entomology.**—Investigations into the effects of different constant temperatures and humidities on the rate of growth of early stages of the three common Indian rat-fleas of the genus *Xenopsylla* were carried out. As the increase and decrease of flea population during different seasons of the year is a factor of extreme importance in the spread of plague, these studies are filling the gaps in our knowledge of the epidemiology of plague.

**Anti-rabic treatment.**—The policy of decentralizing anti-rabic treatment was continued and 14 new centres were opened making a total of 101 in the province. The easy availability of anti-rabic treatment near the patients' homes is making the treatment popular. It is hoped that more centres will be opened in the near future.

## Service Notes

### APPOINTMENTS AND TRANSFERS

COLONEL H. STOTT, O.B.E., V.H.S., is appointed Honorary Surgeon to The King, 30th July, 1940, *vice* Colonel F. F. S. Smith, V.H.S., retired.

The Viceroy and Governor-General has been pleased to make the following appointment on His Excellency's personal staff—*To be Honorary Surgeon*.

Lieutenant-Colonel J. B. Hance, C.I.E., O.B.E., *vice* Colonel E. S. Phipson, C.I.E., D.S.O., vacated. Dated 10th March, 1941.

Lieutenant-Colonel J. Rodger, O.B.E., M.C., an Agency Surgeon, is appointed as Residency Surgeon, Kashmir, with effect from the forenoon of the 2nd April, 1941.

Lieutenant-Colonel F. H. Whyte is appointed Civil Surgeon, Simla West, with effect from the forenoon of the 19th April, 1941.

On reversion to the Military Department, Lieutenant-Colonel C. M. Nicol, Director of Public Health, Punjab, made over charge of his duties to Khan Bahadur Dr. Abdul Hamid Butt, on the afternoon of the 20th April, 1941.

The services of the undermentioned officers of the Indian Medical Service (Civil) are placed temporarily at the disposal of His Excellency the Commander-in-Chief, with effect from the dates stated against their names:—

Major H. W. Mulligan. Dated 17th February, 1941.

Major F. M. Khan. Dated 17th January, 1941. (afternoon).

Major G. W. Miller has been appointed as Principal Medical Officer, Royal Indian Navy, with effect from the 14th February, 1941, with the rank of Surgeon Commander, R. I. N.

Major B. N. Khan is appointed as Deputy Assistant Director-General (Medical Stores), Madras, with effect from the forenoon of 27th March, 1941, *vice* Major W. T. Taylor, appointed as D. A. D. G. (Medical Stores), Bombay.

Major R. L. Frost, Civil Surgeon, Myingyan, was transferred to the Military Department, *vice* Captain S. W. Allinson reverted to Civil employ. He relinquished charge of his duties as Civil Surgeon, Myingyan District, on the forenoon of 29th March, 1941.

Major W. T. Taylor is appointed as Deputy Assistant Director-General (Medical Stores), Bombay, with effect from the afternoon of 31st March, 1941, *vice* Lieutenant-Colonel W. M. Will granted leave.

Major K. H. A. Gross, M.C., an Agency Surgeon, is employed as Administrative Medical Officer in Rajputana, with effect from the forenoon of the 7th April, 1941.

On transfer from Dera Ghazi Khan, Major J. P. J. Little assumed charge of the office of Civil Surgeon, Murree, on the afternoon of the 16th April, 1941.

Captain S. W. Allinson, on reversion from the Military Department to the Civil Medical Department, was posted to duty in the Air Raid Precaution Department in Rangoon.

Captain W. S. Morgan, an Officiating Agency Surgeon, is appointed as Agency Surgeon, Bundelkhand, with effect from the afternoon of the 31st March, 1941.

Captain C. C. Harvey, Civil Surgeon, Sholapur, reverted to Military duty, with effect from the afternoon of 14th April, 1941.

INDIAN LAND FORCES  
(Emergency Commissions)

To be Captains (on probation)

Kundan Lal Jetley. Dated 2nd December, 1940, with seniority from 2nd December, 1933.  
Coimbatore Venkatramana Krishnaswami. Dated 2nd December, 1940, with seniority from 17th February, 1939.

Chuni Lal Bhola. Dated 15th January, 1941, with seniority from 15th January, 1936.

To be Lieutenants (on probation)

2nd December, 1940

Habibullah Khan Khalil.  
Peter Fulgence D'Souza.  
Parimal Kumar Kar.  
Umapati Mazumder.  
Bimal Bikash Biswas.  
Mohammad Kalimuddin Siddiqui.  
Ebenezer John Ramdas.  
Jagannath Hari Joshi.  
Govind Balvant Godbole.  
Siri Krishan Lal.  
Yugal Kishore Champaram Pandit.  
Kanniyath Sankunni Menon Balakrishna Menon.  
Ajit Kumar Bose.  
Tarakad Paramaswara Iyer Sundaram.  
Vindlacheruvu Venkata Narayanamurti.  
Shantaram Vasudev Ghurye.  
Vadilal Damji Shah.  
Sitaram Shrinivas Kirtane.  
Homi Pestonji Bhikhaji Neku.  
Vishnu Gangadhar Pande.  
Bimanesh Bhushan Chatterjee.  
Gaddam Sundara Rami Reddy.  
Padmanabha Pillai Gangadharan Tampi.  
Subodh Kumar Ghosh.  
Faridoon Barjorji Laher.  
Bibhuti Bhusan Chatterjee.  
Narasimha Iyyar Subrahmanyam.  
Mian Khan Chaudhary.  
Chinnammanur Annaswami Rajamani.  
Syed Abdul Qadir.  
Mahendra Nath Sen.  
Shridhar Vithal Garde.  
Narayan Gajanan Aijaonkar.  
Nerur Gopala Aiyangar Srinivasa Ragbavan.  
Jose Geofredo Rodrigues.  
Mohammed Abdul Rasheed Chaudhari.

3rd December, 1940

Satya Dev Malaviya.  
Narayan Trimbak Ghaisas.

2nd January, 1941

Bakhshish Singh Dhillon.  
Abdul Azim Qureshi.  
M. Abdul Shakur.  
Gopal Singh.  
Hafizullah Khan.  
Abdul Hamid Khan.  
Nazir-ud-Din Fatehali Shaikh.  
Tirathdas Mulchand Asani.  
Tarapada Banerjee.  
Sadashiv Ganesh Deosthali.  
Mewa Lal Bhagata.  
Mundoli Pappath Neelakandhan Nambiar.  
Dhunjishaw Behramshaw Doctor.  
Jagadish Chandra Chakrabutty.  
Monoranjan Bhattacharjee.  
Alexander Gama-Rose.  
Gajindar Singh.  
Damoddar Shivram Rege.  
Jayanty Krishnamurthy.

Nusarat Careem Mehra.  
Kothimbakam Rajamannar.  
Sukh Dev Nath Anand.  
Sundar Singh Nagi.  
Tadepalli Shamsunder Row.  
Khushdil Khan Jaswal.  
Mohammad Aslam Khan Khokhar.  
Amolak Ram Sethi.  
Hormasji Manekji Kalapesi.  
Ghulam Hassan.  
Syed Kazim Husain Uraizy.  
Harnand Singh Dhillon.  
Kanwar Bhan Taneja.  
Narindar Singh Ahluwalia.  
Jasbir Singh.  
Trilochan Singh.  
Sharatchandra Laxman Abhyankar.  
Ambica Prasad Dube.  
James Montague Flower.

3rd January, 1941

Thuruthel Chandy John.

15th January, 1941

Khanzada Abdul Lateef Bungash.  
Sudhir Chandra Bose.  
Anwarul Hasan.  
Wasudeo Abaji Nandedkar.  
Pandurang Mukund Bhandarkar.  
Ashutosh Das.  
Amar Nath Kalra.  
Narayan Sheshgiri Gaitonde.  
Amiya Mohan Chakravarty.  
Braja Mohan Pattanayak.  
Sukomal Roy Chowdhury.  
Hukam Chand Dhawan.  
Ernest Edwards.  
Kantilal Kuberji Bhatt.  
Gunyantray Jatashanker Bhatt.  
Edamana Ragbava Menon.  
Balbir Singh.  
Hari Das.  
Navalpakkam Krishnaswami.  
Ratilal Ladharam Pathak.  
Lok Nath Bakhshi.  
Mani Ram Thapliyal.  
Sarvepalli Kesavulu.  
Meembat Achuthan Nair.  
Kuvam Siva Bhushanam.  
Sivangnana Ganeswaran.  
Trichinopoly Vadivelu Ranganathan.  
Cheruvanky Srinivasan.  
Syed Ghulam Haqani.  
Pakiam Samuel Dorai Raja.  
Parashu Ram Saksena.  
Sultan Mohammad Qureshi.  
Arthur William Booth Strahan.

16th January, 1941

Abdus Samad Choudhuri.  
Cheruvathur Job David.  
Chuni Lal Bhatia.  
Donald Robertson.

3rd February, 1941

Peter Storrs Fox.

15th February, 1941

Cecil Macindoe Burnie.  
James Romanes Davidson.  
Angus Leslie Sutherland.

17th February, 1941

Henry Bowlby Tristram Holland.



2nd March, 1941

William Donkin.

## LEAVE

The Governor is pleased to grant leave for 6 months to Major-General P. S. Mills, K.H.P., C.I.E., Surgeon-General with the Government of Bengal, preparatory to retirement, with effect from the 16th May, 1941, or the date of availing.

Lieutenant-Colonel W. M. Will, Deputy Assistant Director-General (Medical Stores), Bombay, is granted leave on medical certificate for 3 months, with effect from the forenoon of 1st April, 1941.

## PROMOTIONS

*To be Acting Major-General*

Colonel J. Taylor, C.I.E., D.S.O., K.H.S., I.M.S. (Retd.), whilst holding the appointment of Director, Central Research Institute, Kasauli. Dated 14th February, 1941.

*Colonel to be Major-General*

A. A. C. McNeill, K.H.S. Dated 27th March, 1941.

*Captains to be Majors*

H. B. MacEvoy. Dated 3rd February, 1941.

F. C. Jackson. Dated 8th April, 1941.

J. D. Grant. Dated 20th April, 1941.

J. W. Bowden. Dated 20th April, 1941.

The seniority of the undermentioned officers in their present rank is antedated to the dates specified:—

Captain S. Rameshwar. Dated 5th March, 1935.

Captain J. R. Vaid. Dated 24th June, 1935.

## RETIREMENTS

Major-General I. M. McCrae, C.B., C.I.E., O.B.E., K.H.P. Dated 27th March, 1941.

Colonel J. Taylor, C.I.E., D.S.O., K.H.S. Dated 14th February, 1941.

Lieutenant-Colonel J. H. Smith. Dated 15th March, 1941.

Lieutenant-Colonel H. C. Tait, M.B.E. Dated 7th April, 1941.

Lieutenant-Colonel L. A. P. Anderson. Dated 18th April, 1941.

## Notes

## HEXOBARBITONE

HEXOBARBITONE (N-methyl-cyclohexenyl-methylbarbituric acid) is now issued by Burroughs Wellcome and Co. as Tabloid hexobarbitone and as the sodium salt, soluble hexobarbitone, the latter for producing anaesthesia of short duration for which it is injected intravenously. Soluble hexobarbitone is of particular value in minor surgery, in simple tooth extractions and to intensify gas-and-oxygen anaesthesia. It may also be used for the induction of general anaesthesia in operations of not more than 20 to 30 minutes' duration, and, by rectal administration, to produce hypnosis and in the treatment of acute and chronic alcoholism. Soluble hexobarbitone (B. W. and Co.) is issued in phials of 0.5-gm. and 1-gm., each strength in boxes of 5 and 25 phials. Each phial is accompanied by a Hypoloid ampoule containing sufficient sterile distilled water to prepare a 10 per cent solution of Hypoloid soluble hexobarbitone.

Tabloid hexobarbitone, gr. 4, is given orally to produce light hypnosis. It is issued in bottles of 25, 100 and 500.

## METHEDRINE

METHEDRINE (*d*-methylisomyn), the issue of which is announced by Burroughs Wellcome and Co., Snow Hill Buildings, E.C.1, is a recently discovered synthetic compound belonging to the sympathomimetic amine group. Given orally, it produces a prolonged rise of blood pressure and stimulation of the central nervous system, especially of the cerebral cortex. Methedrine is particularly indicated in the treatment of narcolepsy; it may also be of value in certain depressive psychopathic conditions, as an analeptic in barbiturate poisoning, and as an antispasmodic in the x-ray visualization of the gastro-intestinal tract.

The compound is issued for oral administration as Tabloid Methedrine hydrochloride, 0.002 gramme, in bottles of 25 and 100.

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## Original Articles

### TOXIC COMPLICATIONS OF SULPHANILAMIDE THERAPY

(AN ANALYSIS OF 6,070 CASES TREATED IN THE VENEREAL DEPARTMENT OF THE GOVERNMENT GENERAL HOSPITAL, MADRAS)

By R. V. RAJAM, M.B., M.S. (Madras), M.R.C.P. (Edin.)  
Venereal Specialist, Government General Hospital,  
Madras

and

N. VASUDEVA RAO, M.B., B.S.

Honorary Assistant Medical Officer, Government  
General Hospital, Madras

THE extensive use of sulphanilamide and its derivatives in the chemotherapy of coccal and bacterial infections has resulted in a certain

afforded us an opportunity for clinical study of the toxic manifestations of the drug.

The majority of the cases undergoing treatment in the department are ambulatory and only those whose illnesses are very acute or who develop a serious toxic complication are admitted to hospital. During the three-year period (October 1937 to October 1940) 6,070 cases were under treatment, of whom 5,076 were males and 994 females. A smaller number of female children were treated in the clinic, but are not included in this paper. Sulphanilamide is the drug in routine use and the costlier, though therapeutically more effective, sulphapyridine was used only in a very small number of cases.

Table I gives an analysis of the toxic reactions noted.

*Fever.*—This is the commonest of the toxic reactions observed in the course of sulphanilamide therapy and occurs in the majority of the cases between the fifth and the tenth day of treatment. Fever either occurs alone or is

TABLE I

	Cases	Complications	Percentage
Total number ..	6,070	1,765	29.08
Males ..	5,076	1,512	29.79
Females ..	994	253	25.45

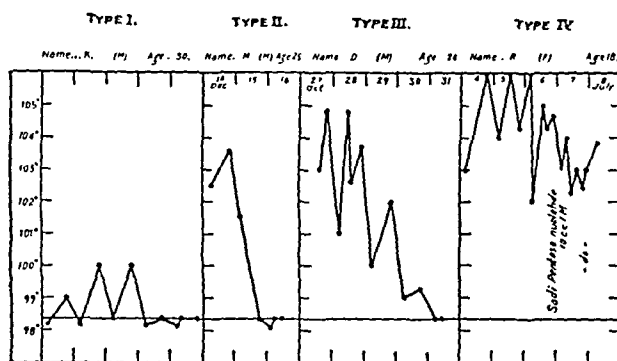
Serial number	Complications	Males	Females	Total	PERCENTAGE		
					Males	Females	Total
1	Fever .. .. .	619	96	715	12.20	9.66	11.78
2	Dermatitis .. .. .	48	9	57	0.95	1.00	0.94
3	Leucopænia with or without granulocytopenia.	23	3	26	0.45	0.30	0.43
4	Agranulocytosis .. .. .	1	2	3	0.02	0.20	0.05
5	Mild anæmia .. .. .	7	2	9	0.14	0.20	0.15
6	Bleeding from the nose .. .. .	6	4	10	0.12	0.40	0.16
7	Profuse menses .. .. .	..	2	2	..	0.20	0.20
8	Bleeding from the bowel .. .. .	..	1	1	..	0.10	0.015
9	Hæmoptysis .. .. .	2	..	2	0.04	..	0.03
10	Bleeding from the gums .. .. .	1	..	1	0.02	..	0.015
11	Breathlessness with or without cyanosis	53	1	54	1.04	0.10	0.89
12	Numbness and tingling of fingers and toes	57	12	69	1.12	1.20	1.14
13	Herpes zoster .. .. .	..	1	1	..	0.10	0.015
14	Diminished acuity of vision .. .. .	6	..	6	0.12	..	0.10
15	Vestibular dysfunction—vertigo, tinnitus and slight deafness.	5	..	5	0.10	..	0.08
16	Gastro-intestinal upset (diarrhœa) ..	44	8	52	0.86	0.80	0.86
17	Headache .. .. .	96	14	110	1.89	1.40	1.81
18	Giddiness .. .. .	171	30	201	3.37	3.00	3.31
19	Nausea, with or without vomiting ..	102	13	115	2.01	1.32	1.89
20	Anorexia .. .. .	68	3	71	1.34	0.30	1.17
21	Pain in chest .. .. .	53	5	58	1.04	0.50	0.96
22	Pain in abdomen .. .. .	58	10	68	1.14	1.00	1.12
23	Pain in joints .. .. .	22	1	23	0.43	0.10	0.38
24	Muscular weakness .. .. .	59	29	88	1.16	2.92	1.45
25	Sore throat .. .. .	11	7	18	0.22	0.70	0.30

incidence of toxic reactions. An increasing volume of literature has been appearing in the medical press regarding the frequency and the severity of these toxic side-effects. The routine treatment of a large number of cases of gonorrhœa, chancroids and venereal lymphogranuloma with sulphanilamide in the venereal department of the Government General Hospital during the past three years has

associated with the development of some other complication such as dermatitis, leucopænia, or breathlessness. Four types of fever were recognized among the cases :

1. A low intermittent fever, the temperature rarely going beyond 100°F., with the evening rise and morning remission, lasting for a few days.
2. A sudden rise of temperature to 103°F. or 104°F., preceded by a chill and coming down by crisis in about 24 hours.

3. The third type is similar to the second except that the fever continues for about three days, slowly coming down to normal on or about the fourth day.
4. In this type, there is severe shivering followed by high fever 104°F. or 105°F.; patient looks very ill and toxic. Blood count reveals a profound granulocytopenia or agranulocytosis.



Graphs showing different types of febrile reaction.

The development of fever is indication for stoppage of therapy and it is our practice to admit these cases as in-patients for observation, and performance of blood count. Only in about 6 per cent of these cases did the blood count show any abnormality. The resumption of treatment brought on the fever of a more severe form in the majority of the patients. In a few cases, change to another derivative of the drug failed to produce the fever and the treatment was continued successfully. It is our impression that the fever in all the cases may not be directly due to the toxic effect of the drug, but may be caused by the liberation and circulation of toxins from some buried focus of infection. The drug fever should be carefully distinguished from fever incidental to the infection for which sulphanilamide is administered. For example, in metastatic complications of gonorrhoea and in venereal lymphogranuloma, fever of varying degree is usually present even before the treatment is started.

**Cutaneous reactions.**—There were 57 cases of drug eruptions in our analysis, of whom 48 were males and nine females. Table II gives a detailed description of the type and distribution of the rash, the dosage of the drug, the day of appearance of the rash, etc.

The eruptions appeared any time from the third to the fourteenth day of sulphanilamide therapy; but in the majority of cases the rash developed between the seventh and the twelfth day of treatment. Two distinct types of rash were observed from the point of view of distribution. The first one (26 cases) was a diffuse eruption involving the trunk, face and limbs. The second type (22 cases) was a localized rash, confined to the parts exposed to direct sunlight—face, neck, extensor aspects of the forearms and hands and dorsal aspects of the feet. A third type (nine cases) complained of intense itching all over the body without any visible eruption.

The following is the classification of eruptions observed :—

Morbilliform	..	..	18
Urticarial	..	..	12
Follicular	..	..	6
Papulo-macular and papular	..	..	5
Erythematous	..	..	4
Scarlatiniform	..	..	1
Bullous	..	..	1

The morbilliform type of eruption seems the commonest. Constitutional disturbance, such as fever and malaise, was present in many of the cases. Ten per cent of these patients with eruptions showed a definite leucocytosis, the leucocytes ranging from 12,000 to 21,000 per c.mm. One case developed a slight leucopenia and in two severe cases, there was a leucopenia with granulocytopenia. Most of the eruptions disappeared in a few days on cessation of therapy. In one case of diffuse urticarial eruption, marked breathlessness, and mental confusion were associated features. A moderate desquamation was observed in four cases of severe diffuse type.

From the table it may be seen that the cutaneous intolerance due to sulphanilamide therapy does not depend so much on the total dose of the drug ingested as on the time factor, seventh to twelfth day of therapy appearing to be the most favourable period for the development of the eruption. The question of resumption of therapy in these cases could not be studied with any precision as many of these patients failed to report again. But in quite a few cases of the light-sensitization type, who reported after a few months for treatment either for the original uncured venereal infection or a fresh infection, we were able to administer the same drug, with a warning to the patients not to expose themselves to direct sunlight, without the recurrence of the skin trouble. Patch tests were not performed to determine the sensitiveness.

Another observation we have made is the relation between the severity of the skin reaction and the therapeutic response of the infection to the drug. In many cases of the diffuse severe type, no matter on what day of treatment they developed, the therapeutic response, particularly in gonorrhoea, was very dramatic and the clinical and bacteriological cure was permanent.

A third of the cases of drug eruption, in our series, were of the light-sensitization type; this is in contrast to the relative infrequency of such eruptions reported by other clinicians from the temperate regions of the world. The strong and powerful sunlight prevalent during the greater part of the year in these latitudes will easily account for the increased incidence of this type of rash. It is our impression that even some of the diffuse types of eruption belong to this light-sensitization type, as many of our

TABLE II

Serial number	Type of cutaneous eruption	Day of rash	Total dose of sulphani- lamide (gm.)	Distribution of rash	REMARKS
1	Follicular	3	12	Trunk and limbs	Diffuse and symmetrical.
2	Morbilloform	9	30½	Trunk, face and limbs.	Do.
3	Do.	6	23	Chest, neck and upper limbs.	Diffuse.
4	Do.	5	13½	Trunk, face and extremities.	Diffuse (slight leucopænia).
5	Do.	5	30	Trunk, face and limbs.	Do.
6	Follicular	8	33	Chest and back	Leucocytosis.
7	Do.	12	30	Trunk and face	Do.
8	Morbilloform	10	29	Hands, face and forearms.	Light sensitive. Marked leucocytosis 20,625.
9	Do.	4	12	Face only	Photo sensitive.
10	Erythematous	4	18	Trunk and limbs	Diffuse.
11	Maculo-papular	10	39	Do.	Do.
12	Morbilloform	10	39	Face, neck, feet and forearms.	Light sensitive.
13	Do.	12	45	Face only	Light sensitive (five months later was put on streptocide without developing rash).
14	Macular	9	36	Do.	Light sensitive (leucocytosis).
15	Erythematous	7	21	Face, forearms and feet.	Light sensitive.
16	Do.	7	22	Face and neck	Do.
17	Erythematoma- macular.	7	21	Face, hands and feet.	Do.
18	Morbilloform	9	37½	Face, neck and forearms.	Do.
19	Do.	8	34½	Trunk, limbs and face.	Diffuse.
20	Papulo-urticarial	11	43½	Face only	Light sensitive.
21	Urticarial	9	37½	Trunk, limbs and face.	Breathlessness and mental confusion—leucocytosis.
22	Morbilloform	8	24	Exposed parts—face and forearms.	Light sensitive.
23	Scarlatiniform and urticarial.	7	31½	Trunk, limbs and face.	Leucopænia with granulocytopenia. Marked desquamation.
24	Morbilloform	9	27	Trunk, face and arms.	Diffuse.
25	Do.	9	37½	Face, trunk and limbs.	Diffuse. Leucocytosis 18,750. Marked desquamation.
26	Bullous dermatitis, with extensive mucosal lesions.	9	37½	Trunk, face, limbs, mouth, lips, eyelids, conjunctiva and cornea.	Initial high fever, leucocytosis followed by leucopænia—marked exfoliation—pigmentary scars all over—ulcer cornea.
27	Morbilloform	10	40½	Exposed parts—face, neck, forearms and limbs.	Light sensitive. Leucocytosis.
28	Do.	7	31½	Face, neck, forearms and hands.	Light sensitive.
29	Urticarial	3	8	Trunk and limbs	Diffuse.
30	Do.	9	36	Do.	Do.
31	Do.	3	13½	Trunk	Three months after tolerated streptocide without rash.
32	Do.	9	34½	Trunk and limbs	Diffuse.
33	Do.	4	18	Distal half of the extremities.	Light sensitive.
34	Do.	4	13½	Trunk	
35	Do.	14	60½	Face only	Light sensitive.
36	Do.	7	21	Face and hands	Do.
37	Do.	5	22½	Trunk and limbs	Fever, pain in the limbs.
38	Do.	8	34½	Trunk, limbs and face.	
39	Pruritus	7	30	All over the body	
40	Do.	6	22½	Exposed parts—face and forearms.	Light sensitive.
41	Do.	11	43½	All over the body	
42	Pruritus and stomatitis.	4	18	All over the body. Herpetiform ulcers on the buccal mucosa, pain stomach.	

TABLE II—concl'd.

Serial number	Type of cutaneous eruption	Day of rash	Total dose of sulphanilamide (gm.)	Distribution of rash	REMARKS
43	Pruritus	7	21	All over the body	
44	Do.	8	33	Do.	
45	Do.	3	9	Do.	
46	Do.	9	40½	Do.	
47	Do.	5	22½	Do.	
48	Do.	8	33	Do.	
49	Morbilliform	12	36	Trunk, face and limbs.	
50	Follicular	6	18	Forearms and hands.	Light sensitive.
51	Morbilliform	21	63	Trunk, face and limbs.	Marked desquamation.
52	Follicular	7	21	Face, forearms and feet.	Light sensitive.
53	Morbilliform	9	24	Face only	Do.
54	Follicular	3	9	Face and forearms	Do.
55	Papular and pustular.	7	21	All over the trunk and limbs.	
56	Urticarial	10	30	All over the body	
57	Urticarial and papular.	5	15	Exposed parts—face and hands.	Light sensitive.

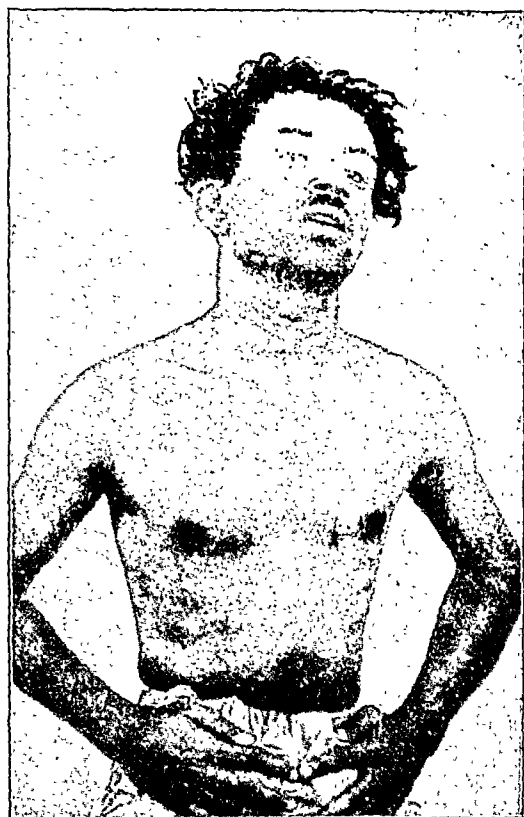
poorer patients wear only a loin cloth exposing the greater part of their skin to direct sunlight.

According to Tedder (1939), three factors are involved in the causation of sulphanilamide

family resemblance to the ninth-day erythema met with the arsenobenzene compounds. Another theory put forward by the same author (1938) is the activation of some buried focus of infection by sulphanilamide liberating toxins from the focus.

We have not encountered a case of true allergy, in which a single dose of the drug has induced the cutaneous intolerance. The theory of sensitization is advanced on two grounds:—  
1. In such allergic cases, a normal elimination of the drug in the urine is demonstrated.  
2. They remain sensitive to the drug for months and a single small dose brings on the rash in a few hours. In our opinion, the toxic factor appears to be the more important cause of drug rash, particularly of the generalized type in which retention of the drug occurs in the body, due to faulty or inefficient elimination in the urine. The associated or coexistent constitutional disturbance of malaise and fever observed in the majority of cases of generalized eruptions in our analysis lends support to the toxic factor as being the main cause of the diffuse type of drug eruptions.

Rimington and Hemmings (1938) have shown that during sulphanilamide therapy there is an increased production of porphyrin together with coproporphyrin I. This latter substance is a photo-sensitizer and its production varies in degree in different individuals. Epstein (1939) distinguishes true light sensitization from photo allergy. The former is a direct light sensitization caused by the drug and the latter is indirectly due to the drug by the production of porphyrin and coproporphyrin I. The relative infrequency of the photo-sensitive type of drug eruptions noted by clinicians in temperate latitudes, where powerful sunlight is a desideratum, is accounted for by the variation in the production of porphyrin in individual cases.



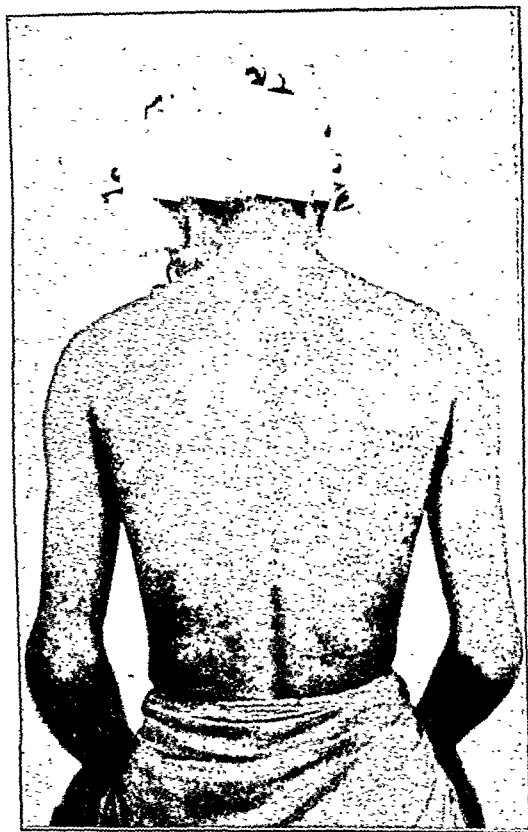
Morbilliform rash (sulphanilamide). Anterior view.

rash:—1. Sensitization. 2. Toxic effect. 3. Light sensitization. Erskine (1939) is of opinion that these eruptions, occurring mostly towards the end of the first week of therapy, bear a close

The greatly increased incidence of this type of cutaneous reaction in our latitudes suggesting that the increased production of photo-sensitizing substance during sulphanilamide therapy may be dependent more upon the sunlight than upon individual bodily tissue reaction; or it may be that the cases of light-sensitization type of eruption in our series are cases of true light sensitization caused directly by the drug.

The notes of our only severe case of cutaneous and mucosal lesions caused by sulphanilamide is given below:—

The patient, a male, aged 30 years, was admitted to the wards of the venereal department on 23rd August, 1940, with a purulent urethral discharge, acute strangury, and difficulty in micturition. Investigation showed him to be suffering from an acute gonococcal urethritis with prostatitis. He was put on sulphanilamide tablets at the rate of  $4\frac{1}{2}$  gm. daily. He received



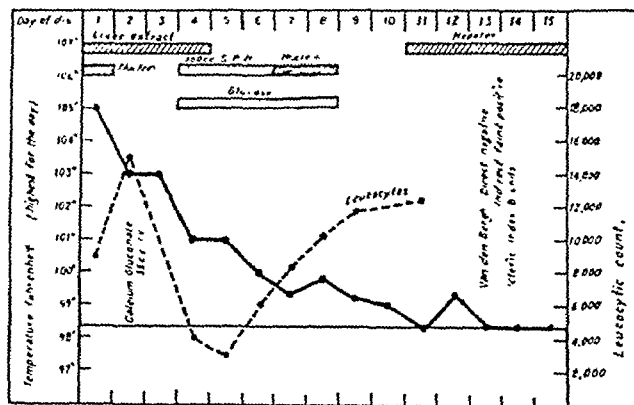
Morbilliform rash (sulphanilamide). Posterior view.

$4\frac{1}{2}$  gm. daily for seven days and 3 gm. daily for two more days and as his condition greatly improved, he was discharged from the wards on 31st August, 1940, and advised to continue treatment as an ambulatory patient. He had taken  $37\frac{1}{2}$  gm. of the drug in nine days.

On 2nd September, two days after discharge from the wards, he reported very ill and was immediately admitted. On examination, he had extensive eruptions all over the face, trunk, limbs and genitals. The lesions were pleomorphic on the first day, consisting of papular and bullous types, the latter predominating. He had severe cheilitis, stomatitis with fissures and ulcers on the lips, palate, pharynx with a considerable oedema so that the patient was scarcely able to open the mouth. Intense conjunctivitis with blepharitis in both eyes was present. The patient looked extremely toxic with an initial temperature of  $105^{\circ}\text{F}$ , pulse 132 and

respiration 40. Within 48 hours the entire skin of the body, face and limbs was covered with grouped and confluent bullous lesions, of varying sizes and shapes, which rapidly burst leaving large raw weeping areas. The eyelids were swollen, shut with discharge and crusts. The mucous membrane of the lips, tongue and palate was grossly inflamed, fissured, ulcerated and easily bleeding. The blood count showed an initial leucocytosis on the first two days of admission but suddenly dropped to 4,000 and 2,750 leucocytes on the fifth and sixth day after admission. The other findings of the blood were normal.

After about five days' treatment the patient turned the corner and started to mend. The temperature came down, the leucocyte count went up, the skin lesions started drying up and exfoliating. The inflammation of the mucous membranes with the exception of the right eye showed a gradual subsidence. An acute ulcer of the right cornea developed with prolapse of the iris which ultimately seriously compromised the vision in that eye. During the involution stage of the skin lesions the patient shed all his nails, and the skin of the palms and soles was coming away in thick flakes. A few subcutaneous abscesses were opened and drained. The healed bullous lesions on the skin of the trunk and face left pigmented, mottled and vitiliginous patches. Towards the end of the second week, recovery was almost complete except for the eye condition. The accompanying chart shows the progress in the temperature and blood findings and also the treatment adopted in the case.



*Leucopenia and granulocytopenia.*—A reduction of the total leucocyte count or granulocyte count, or both, was discovered in about 26 cases. In all the patients, the drug was immediately stopped and they were kept under observation. Regular daily leucocyte counts were performed on them. All the cases, after a few weeks, completely returned to normal. In a few of them, sulphanilamide therapy was restarted without their developing any recurrence of this blood dyscrasia. In three cases, the reduction in leucocytes was observed towards the end of the first week of therapy, the rest occurring at the end of the second week.

*Agranulocytosis.*—This grave complication of sulphanilamide therapy is reminiscent of a similar grave intoxication of arsenobenzene therapy, i.e., encephalitis, in that both conditions are almost unpredictable and occur with startling and dramatic suddenness from an almost unclouded sky without any premonition. It is usually asserted that the clinician will be forewarned of the grave complication if daily blood counts are performed on patients receiving sulphanilamide therapy. Our observations on the very large number of cases receiving



sulphanilamide in the venereal clinic of the General Hospital do not bear out this contention. There seems an inevitability about the development of agranulocytosis, which appears to occur on a basis of individual idiosyncrasy, rather than as a toxic manifestation. The rarity of this complication, considering the thousands of patients treated with this drug all over the world for the past few years, is evidence of an as yet undetermined susceptibility in a few individuals. In the three years of routine sulphanilamide therapy in the venereal clinic of the Government General Hospital, approximately 2,70,000 grammes of sulphanilamide were administered to about 6,000 patients. Three cases of acute agranulocytosis, in one male and two females, occurred during the period under review. All the three cases ended fatally in spite of treatment.

The male patient, who was receiving treatment for acute gonorrhœa, completed three weeks' course of sulphanilamide totalling 72 grammes. The day after the last day's sulphanilamide the patient suddenly took ill with shivering and fever. The initial temperature was 105.6°F. The patient looked extremely toxic and within 12 hours became delirious. Blood examination revealed 1,500 total leucocytes with a complete absence of granulocytes. For four days he was swinging between life and death and died on the fifth day of a terminal pneumonia. Anginal symptoms were absent. In this case the routine weekly blood counts in the first and second week of sulphanilamide therapy did not reveal any abnormality. The other two fatal cases were young adult women who were treated for gonorrhœa. Both cases had 14 days' treatment with sulphanilamide. One of them developed high fever four days and the other six days after cessation of therapy. The leucocyte count in one was 500 and in the other 1,600, with complete absence of granulocytes in the former and 3 per cent in the latter. One of the women suffered also from a severe angina of the throat. In spite of treatment with sodium pentose nucleotide, glucose and blood transfusion, both cases terminated fatally, the one five days and the other three days after onset of the illness.

A mild anæmia has been noted in nine cases during therapy, with a reduction in the red cell count and hæmoglobin content. We have not regarded these cases of mild anæmia as grave toxic manifestations. Temporary cessation of therapy with administration of iron by mouth has enabled us to restore the defect and then continue the therapy without any ill effect. No case of hæmolytic anæmia was encountered in our series.

A number of cases of *unexplained bleeding* from different orifices of the body was observed in our cases:—ten cases of epistaxis, two of profuse menses, two of hæmoptysis, one of bleeding from the rectum and one of bleeding from the

gums. In all these cases the bleeding stopped with the cessation of therapy, but recurred with resumption of treatment. Examination of the blood failed to reveal any abnormality. It is curious that there was no case of hæmaturia in our series treated with sulphanilamide.

*Slight breathlessness* with or without cyanosis was present in about one per cent of the cases and with a marked predominance in the male patients. It was observed as early as the second day of therapy or was delayed up to the end of the second week. This complication was usually associated with slight fever, dry throat, and retro-sternal pain. In almost all the cases the treatment was continued without any mishap. In two cases of marked cyanosis with breathlessness, the patients were admitted to hospital for a few days with cessation of treatment. Spectroscopic examination of the blood failed to reveal any abnormal bands. In most of the cases the breathlessness was noticed only on exertion.

*Numbness and tingling of the fingers and toes* were complained of by a little more than one per cent of cases of either sex during treatment. There was no definite peripheral neuritis.

*Diminished acuity of vision* was present in six cases—all males; but, in only one case after four days of therapy, the ophthalmologist reported early optic neuritis with a central scotoma for blue in the left eye. With the stoppage of treatment the vision returned to normal in all the cases. In the other five patients, the complaint was purely subjective and came on after the second or third day's therapy.

There were four cases of *vestibular dysfunction* characterized by vertigo, tinnitus and slight deafness, which passed off. This mild occasional toxic involvement of the optic and the auditory nerves, is usually evanescent and the treatment was in no way interfered with.

A solitary case of *herpes zoster* in the distribution of the seventh dorsal nerve in a woman who was treated for a particularly resistant type of Neisserian infection was seen in the clinic. The complication occurred on the seventeenth day of treatment after a total dosage of 51½ gm. of sulphanilamide. The condition was accompanied by mild fever, headache, severe neuralgic pain along the nerve and intense burning over the crops of herpetic vesicles. Treatment was stopped and the condition subsided gradually with forcing of fluids and glucose and exhibition of vitamin B<sub>1</sub>.

*Clinical acidosis* has not been encountered in any of our cases since it has been the routine practice to prescribe an alkaline mixture to be taken along with the sulphanilamide.

In about 0.8 per cent of either sex, gastro-intestinal upset and diarrhœa were prominent minor reactions of the drug.

Some of the minor reactions like *giddiness, headache, nausea and vomiting* were complained

of by the patients in the first two or three days of therapy, but tended to disappear with the continuation of the treatment.

A minority of patients complained of pain in different parts of the body, chest, abdomen, joints and muscles.

*Mental disturbance*, a sort of toxic psychosis, in the form of mental confusion was observed in one case of drug dermatitis associated with breathlessness. Muscular weakness was found to be twice as common in women patients as in men, but it did not interfere with the maintenance of therapy.

Toxic hepatitis with or without jaundice was conspicuously absent with sulphanilamide in our series, but two cases of jaundice were met with among a smaller number of selected paying cases treated with sulphapyridine in the clinic. As only 30 cases were under sulphapyridine treatment during the period under review the toxic complications of this drug are not included in this study.

*Comment.*—The incidence of the toxic complications of sulphanilamide seems to be almost equally distributed between the sexes with a slight preponderance of the blood dyscrasias in women. Taking agranulocytosis alone, the incidence in women is one in about 500 patients, whereas in men it is about one in 5,000 patients. The danger of this often fatal complication seems to be ten times more frequent in women. It is obvious from the analysis of the toxic reactions that with the single exception of agranulocytosis the other toxic effects of sulphanilamide therapy are not grave reactions jeopardizing life. In most of these cases the treatment could be safely continued with proper precautions with or without a certain interval of rest. We are also convinced that, with the exception of agranulocytosis, the other toxic manifestations occurring in the first two weeks of therapy can be recognized by daily and careful observation of the patients. An attitude of over-cautiousness seems to prevail among sections of the medical profession regarding the dangers of the new chemotherapy. It is our opinion that sulphanilamide and its derivatives should be used with greater resolution than has hitherto been shown and that clinicians should not hesitate to administer this drug in therapeutically adequate doses. Having said so much it is essential to emphasize that patients receiving sulphanilamide or one of its derivatives should be kept under daily and careful observational control. Enquiry should be made for symptoms such as fever, headache, malaise, vomiting and pain. Examination of the skin for rash, of the mucous membrane for pallor or jaundice, and observation of the temperature for drug fever, should form part of the daily routine of sulphanilamide therapy. As many of the toxic manifestations occur towards the end of the first week of treatment, observation

of the patient should be more detailed and careful from and after the end of the first week.

It has been our routine practice to have a blood count performed at the end of the first and second weeks of therapy, or whenever the patient develops fever, rash, breathlessness, or suffers from the persistence or increase in severity of a minor toxic manifestation such as headache or vomiting, etc. Daily blood counts are no doubt ideal, but, in the exigencies of the out-patient venereal practice, when 200 to 300 patients have to be dealt with and disposed of daily, blood examination on an average of 100 patients who would be receiving sulphanilamide for one or the other of the venereal diseases, would be a terrible strain on the medical staff of the department.

Since our analysis of the drug rash has shown that nearly a third of the skin eruptions is of the light-sensitive type, patients should be strictly warned not to expose their naked skin to direct sunlight during sulphanilamide treatment.

In conclusion, the clinician should bear in mind that if a patient has drug fever, rash, leucopenia, cyanosis, or persistence of a seemingly minor trouble such as vomiting and diarrhoea, the drug should be immediately stopped; and the rapid excretion of the drug should be promoted by the ingestion of fluids and glucose. Oral administration of nicotinic acid has been recommended both for prevention and the treatment of the toxic complications of sulphanilamide and its derivatives. In cases where further therapy is indicated, either the same drug or one of its other derivatives in a much smaller single dose should be cautiously administered and a watch should be kept for the recurrence of the toxic manifestations.

#### SUMMARY

1. An analysis of the toxic complications of sulphanilamide therapy in the venereal department of the Government General Hospital is attempted.
2. Over 6,000 cases of both sexes who had received between them 2,70,000 grammes of sulphanilamide are reviewed.
3. Some of the complications are discussed in detail, particularly the cutaneous reactions and the blood dyscrasias.
4. The much greater frequency of the light-sensitive type of sulphanilamide rash is noted.
5. A plea is made for an optimistic attitude towards the new therapy and for the use of the drug in therapeutically adequate doses.
6. Necessity for daily careful observation of the patients receiving the new therapy aided by frequent blood count estimation is stressed.

(Continued at foot of next page)

## A STUDY OF CARDIAC SOUNDS AND MURMURS IN SEVERE ANÆMIA

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THE presence of cardiac murmurs in cases of severe anæmia is a very common finding. The murmur is mostly a systolic one, heard best at the mitral area. So frequent is its occurrence in cases of anæmia, that this murmur is called a hæmic murmur.

In the present series of cases an attempt was made to study the cardiac sounds and murmurs in anæmias, and also to see the frequency and character of the diastolic and pre-systolic murmur in these cases. Again, an attempt was made to correlate the blood picture with these murmurs. With this end in view, frequent blood counts were made and the cardiac changes recorded daily or less frequently.

An interesting finding was the presence of diastolic murmurs. These diastolic murmurs in cases of anæmia have always been regarded sceptically by clinicians, and their *modus operandi* is not well understood. It was found in some cases that a pericardial rub was also detected with the diastolic murmur. Both the rub and diastolic murmur cleared up on treatment of the anæmia, showing that they were not due to any organic lesion of the heart. In cases where a definite diastolic murmur was detected, an electro-cardiogram and teleradiogram were taken to find out if there was any chance of the lesion being an organic one.

### Technique

1. *Selection of cases.*—Only cases of very severe anæmia likely to give a total red cell count of about a million per c.mm. were selected. Ankylostome cases were preferred because they present varying grades of

(Continued from previous page)

We are thankful to the superintendent of the Government General Hospital for permission to utilize the records of the department and to the staff of the Barnard Institute of Radiology for the clinical photographs.

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anæmia, are mostly free from other complications and are more amenable to treatment. Cases of other types of anæmia were also included and thus the report represents fairly the conditions prevalent in this part of the United Provinces.

Cases of anæmia of pregnancy were avoided because of the alteration in cardiac findings in these cases due to enlarged abdomen. For this same reason cases with ascites had to be excluded.

2. *Examination of cases.*—After a careful clinical examination a detailed blood study was undertaken. All blood studies were carried out by using counting chambers and pipettes which were certified by the United States Bureau of Standards to be correct. For hæmoglobin estimations, Hellige's hæmometer was selected using Sahli's standardized scale so that 14.5 gm. were equivalent to 100 per cent (Wintrobe, 1930).

The detailed blood investigation consisted of the following observations repeated bi-weekly, or less frequently:—Total red cell and white cell counts, hæmoglobin estimation, differential leucocyte count and the general blood picture, the average cell diameter by Eve's halometer, and the reticulocyte percentage; the last named was repeated daily during the early stages of anti-anæmic treatment.

3. *X-ray findings.*—Teleradiogram and electro-cardiogram were taken under standard conditions in the x-ray department of King George's Hospital. For the teleradiogram, the patient was kept in the erect posture; he was instructed to take shallow breaths. After his initial excitation, due to new surroundings, had passed off, he was instructed to hold his breath in mid-inspiration when the plate was exposed (White, 1937).

### Observations

A very frequent finding was the presence of murmurs, mostly systolic, which either disappeared altogether or altered in character with the improvement of anæmia. The murmur was systolic, as mentioned above, and was best heard on left side of chest about the fourth intercostal space, though in a fair number of cases it was equally well heard in the pulmonary area. However, murmurs other than systolic were also found.

Three cases in the series presented a definite diastolic murmur which was sharply localized to the apex. These cases were carefully observed and electro-cardiograms and teleradiograms taken (plate XVII, figs. A, B, and C and plate XVIII, figs. 1, 2, and 3) but no evidence of any organic lesion could be found. On the contrary, it was shown that the murmurs were functional only, since they disappeared a few days after admission. In two of these cases the murmur disappeared on improvement of anæmia, while in one case it developed after blood transfusion, and disappeared a week later.

One case (case 2) presented a pericardial rub along with a diastolic and systolic murmur at the apex. She looked a typical case of mitral lesion with secondary failure but electro-cardiogram and teleradiogram showed no mitral involvement. The case proved to be a functional one by the complete disappearance of all signs and symptoms on her regaining the normal blood count, and when seen eight months

after discharge, she was free of all signs and symptoms.

The following is a brief summary of cardiac findings:—

TABLE  
*Summary of the auscultatory findings in the heart*

Serial no.	On admission	On discharge	Observed changes
1	Soft systolic murmur in the mitral area not conducted except for a short distance towards axilla. Pulmonary area also a soft systolic murmur.	Mitral and pulmonary murmur much less marked.	Murmurs have markedly diminished in intensity.
2	(1) Systolic murmur in all the four areas. (2) Mitral systolic conducted up to the axillary line.	No murmur at all	All the murmurs have disappeared.
3	(3) A short rough late diastolic murmur in mitral area in the 6th space not conducted. (4) Pericardial rub at the 5th space nipple line.	No murmur in any area	Murmur has disappeared.
4	Both sounds clear. No murmur in any area except mitral, where a short, soft systolic murmur localized in that area is heard.	Systolic murmur much softer. 1st sound audible. Conduction of murmur much less.	Altered in character.
5	Pulmonary 2nd sound accentuated. (1) A harsh systolic murmur in the mitral area conducted to anterior axillary line. (2) 1st sound replaced by murmur. 2nd sound clear.	A short, soft systolic murmur in mitral and pulmonary area.	Murmurs much less marked.
6	(3) Pulmonary and aortic areas also show harsh systolic murmurs.	No murmur in any area	Had no murmur on admission.
7	Both cardiac sounds distinctly heard in all the areas. No murmur detected at all.	Sounds clear. No murmur	Murmur disappeared.
8	1st sound in mitral area prolonged into a soft systolic murmur, conducted an inch towards the axillary line.	1st sound in mitral area prolonged only. No murmur in any area.	Murmurs disappeared.
9	A short soft systolic murmur in the mitral area conducted slightly towards the axilla. Pulmonary and aortic areas also reveal short soft localized murmur.	Murmur just the same. No change.	No change.
10	Soft systolic murmur in all the areas. Mitral systolic localized in the 5th space about the nipple line.	Very feeble systolic murmur in mitral and pulmonary area. Following (4 months after) no murmur at all.	All murmurs including diastolic have disappeared.
11	(1) Systolic thrill in the præcordium. (2) In mitral 1st and 2nd sounds heard. A harsh systolic murmur conducted only for an inch to axilla.	Mitral systolic murmur still heard. It is conducted to anterior axillary line.	Not much alteration in murmurs.
12	(3) At the 4th rib in the mammary line, there is a short, harsh late diastolic murmur heard over an area 1½ inches in diameter. 2nd sound inaudible in this area. Systolic murmur was also heard at the base of the heart.	Mitral murmur faintly audible on careful examination. Others also almost absent. Pulmonary 2nd still accentuated.	Murmurs have almost disappeared.
13	(1) Mitral area shows a short soft systolic murmur localized round about the nipple. (2) Systolic murmur was also heard at the base of the heart.	No murmur	Had no murmurs at all on admission.
14	(3) Pulmonary 2nd sound accentuated.	Systolic murmurs though present are much less marked.	Diminished in intensity.
15	1st and 2nd sounds distinctly heard. No cardiac murmur detected.	Murmurs though audible are much less marked. Pulmonary 2nd still accentuated.	Do.
16	Soft systolic murmur in the mitral area conducted towards the anterior axillary line. Sounds clear. Pulmonary area shows a clear systolic murmur.		
17	(1) A short soft systolic murmur best heard in pulmonary area. (2) Short soft systolic murmur in mitral area not conducted except for a short distance towards axilla. (3) Both mitral sounds clear. (4) Pulmonary 2nd accentuated.		

TABLE—concl'd.

Serial no.	On admission	On discharge	Observed changes
16	(1) A clear, softish systolic murmur in the mitral area not conducted. (2) Sounds distant and feeble.	(1) Pulmonary rough murmur as before. (2) Pulmonary 2nd sound accentuated. No reduplication. (3) Mitral murmur less marked.	Diminished in intensity.
17	(3) Pulmonary 2nd accentuated and reduplicated. Has a systolic murmur at the base as well. (1) Soft systolic murmur in mitral area conducted to anterior axillary line. (2) 1st mitral sound replaced by murmur. (3) Pulmonary area also shows localized systolic murmur. (4) Pulmonary 2nd accentuated, systolic murmur in other areas also.	Died	
18	Sounds distant but clear in all the areas. No murmur at all. 2nd pulmonary sound accentuated.	Mitral sounds clear. No accentuation of pulmonary 2nd now.	Alteration in character of sounds.
19	1st sound in mitral area is prolonged into a short systolic murmur. Pulmonary area shows a clear systolic murmur.	Mitral area shows no murmur. Pulmonary systolic murmur still heard.	Disappearance of mitral systolic murmur.
20	Sounds are rather distant but clear. No murmur in any area.	No murmur. Sounds clearly heard.	Sounds became more clear. Had no murmur.
21	No murmur in any area. Sounds clearly heard.	There was no murmur on admission.	Never had a murmur in the heart.
22	(1) Soft systolic murmur in the mitral area not conducted to axilla.  (2) Soft systolic murmur at the base as well.	A short soft systolic murmur in the mitral area slightly conducted towards axilla. Patient has also since a week developed a short late diastolic murmur localized strictly to 5th interspace just below the left nipple.	Had a diastolic murmur also. Systolic murmurs unaffected.
23	Mitral area shows a soft systolic murmur conducted to the axillary line. Pulmonary area also shows a systolic murmur.	No change in murmurs	No change.
24	(1) A short soft systolic murmur in the mitral area conducted slightly to axilla. (2) Clear short systolic murmur in pulmonary and aortic areas.	1st sound in mitral area rather prolonged. No murmur. Pulmonary systolic also indistinct.	Murmur has disappeared.
25	(1) A short soft systolic murmur localized in mitral area. (2) A more distinct murmur in pulmonary area.	No murmur at all	Murmurs have disappeared.
26	A rather short soft systolic murmur in the mitral area conducted for a short distance towards the axilla. Murmur in pulmonary area best heard.	No murmur in any area	Do.
27	No murmurs in any area.	No murmur in any area	Had no murmur on admission.
28	(1) A short soft systolic murmur in the mitral area not conducted to axilla. (2) A loud systolic murmur in pulmonary area.	1st sound in the mitral area slightly prolonged. No murmur at all.	Murmurs have disappeared.
29	A harsh systolic murmur in the mitral area conducted to anterior axillary line.	Soft systolic murmur in the mitral area.	Murmur has become soft in nature.
30	Soft systolic murmur in the mitral area conducted to anterior axillary line. More definite systolic murmur in pulmonary area.	Not followed for a long period	No change.
31	Soft systolic murmur in mitral area. Less distinct in pulmonary area.	...	Do.
32	Short soft systolic murmur in mitral area; also in pulmonary area.	...	Do.
33	No murmur. Sounds clear.		
34	Nil abnormal except for a short systolic murmur in the mitral area.	Died	

Summary abstract	Incidence	Percentage
1. Murmurs present ..	29 out of 35	82.8
2. Murmurs absent ..	6 out of 35	17.2
3. Murmurs disappeared on improvement of anæmia.	10 out of 27	37.0
4. Murmur diminished in intensity.	6 out of 27	22.2
5. Murmur altered in character.	2 out of 27	7.4
6. No alteration in murmur at all.	6 out of 27	22.2
7. Diastolic murmur ..	3 out of 35	8.6

Two patients died and so were not followed for any length of time.

*Discussion.*—It is thus found that no less than 82.8 per cent of cases of severe anæmia present cardiac murmurs. These murmurs disappeared completely on improvement of anæmia in 37 per cent, while in another 33 per cent they either diminished in intensity or altered in character: the harsh blowing murmurs became soft, while soft murmurs became practically inaudible. Thus, about 70 per cent of cases admitted with cardiac murmurs showed definite changes in murmurs with the improvement of anæmia.

It is interesting to note that 17.2 per cent of cases of very severe anæmia had no murmurs at all even on admission. It is difficult to account for this difference in behaviour of two hearts with the same kind of blood picture.

#### *Discussion and reference to literature*

Diastolic murmurs have been recorded from time to time in cases of anæmia. As early as 1861, Friederich (1861) described a patient with secondary anæmia who presented a diastolic murmur during life, but in whom post-mortem examination revealed no abnormality in any of the heart valves. Subsequently von Noorden (1891) described three such cases in one of which a post-mortem examination was performed. In one the murmur was diastolic, and in the other two pre-systolic; in one patient the murmur disappeared as the anæmia improved. Sahli (1895) recorded two cases of severe secondary anæmia with cardiac enlargement and diastolic murmur at the left border of the sternum. Cabot and Löcke (1903) and Ortnier (1923) were the next to report such observations. Morse (1924) noticed diastolic murmur with water-hammer pulse and pistol-shot sounds in the arteries in infants and children with marked anæmia, and observed their disappearance with the improvement of blood. Again, Kraus (1905) observed diastolic murmur in eight cases of pernicious anæmia amongst a group of 47, and also found such reports in ten of eighty-three cases that he collected from the literature.

The latest reports have been from Goldstein and Boas (1927) and Gunewardene (1933) who also have recorded functional diastolic murmurs

in cases of severe anæmia. White (1937) has described functional mitral stenosis producing a mitral diastolic murmur, which is attributed to considerable dilatation of the left ventricle with normal valves. High grades of anæmia from any cause is mentioned as one of the causes of this clinical condition.

Though the diastolic murmur has been detected in cases of severe anæmia, it has by no means been a common experience. The hospital records of the last five years of King George's Hospital have been looked up, but there has been only one case of a Hindu male admitted for anæmia who presented a functional diastolic murmur. In the present series of cases, it has been found in 8.6 per cent of cases, probably because the murmur was especially looked for in all cases. The murmur in all these cases disappeared a few days after admission, thus establishing that it was not an organic one.

The murmur is usually best heard on the left side of the sternum at the fourth intercostal space about the nipple line, though in one case it was apical. In one case the diastolic murmur was accompanied by a pericardial rub, and a systolic murmur. The picture of the patient with œdema of the feet, tender liver, and distended jugulars, suggested a case of mitral lesion with secondary heart failure, but it was shown to be a non-mitral one by a normal electrocardiogram and teloradiogram. The disappearance of all signs and symptoms and the return of the heart to normal on improvement of anæmia also confirmed the non-organic nature of the lesion. This case was seen eight months after discharge from the hospital and was found to be free of all evidence of cardiac abnormality, and had a normal blood picture. In two other cases, the diastolic murmur was transient, lasting for two days in one, and about a week in the other. These diastolic murmurs, though observed by various workers, have not yet been satisfactorily explained.

#### *Summary and conclusions*

Cases of severe anæmia occurring in the United Provinces of Agra and Oudh were investigated from the point of view of cardiac findings, particularly the heart sounds and the cardiac murmurs.

A detailed study of the blood was made on admission and the cases treated for anæmia. A detailed record of the cardiac sounds and murmurs was made on admission and then followed from day to day *pari passu* with the improvement in anæmia. The following conclusions have been drawn:—

(1) That presence of systolic murmur in these cases is a very common finding. The systolic murmur is mostly found in all the areas, but is often well marked at the apex. In some cases it was most distinct in the pulmonary area.

(Continued at foot of next page)



## PERFORATION OF A MECKEL'S DIVERTICULUM WITH GASTRIC MUCOSA

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MECKEL'S diverticulum, which is due to the persistence of a portion of the vitelline duct or yolk stalk, may, or may not, cause any abdominal symptoms. The incidence of Meckel's diverticulum varies according to institutions. Johns Hopkins Hospital reported 15 cases out of 2,600 autopsies, while Mitchell of Chicago reported 39 cases out of 1,635 autopsies. Out of 1,500 abdomens opened by the author, four cases of Meckel's diverticulum were found of which two were found accidentally while operating for duodenal ulcers. On section, these diverticula did not show any evidence of gastric mucosa. One of the other two cases was one of strangulated hernia of 11 days' duration

(Continued from previous page)

- ✓ (2) That diastolic murmurs in cases of severe anæmia are occasionally met with. The murmur is usually a late diastolic murmur best heard on the left side of the sternum at the fourth intercostal space about the nipple line. This diastolic murmur is not organic, but its cause has not been elucidated.
- ✓ (3) That the pulmonary second sound is accentuated in a fair number of cases of anæmia.

### Acknowledgments

I am greatly indebted to Captain R. D. Alexander, formerly Professor of Medicine, King George's Medical College, Lucknow, who very kindly directed me in this work, also to Dr. R. Lal, radiologist to King George's Hospital, for his kindly affording the facilities of his department.

I have further to thank Colonel H. Stott, I.M.S., formerly Professor of Pathology and Dean of the Faculty of Medicine, for his kindly providing me with a research laboratory, and to the members of the visiting staff of King George's Hospital for permitting me to use their cases.

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where the Meckel's diverticulum along with the loop of the bowel was found to be gangrenous, and in the other case perforation of the diverticulum causing peritonitis demanded an immediate laparotomy. In Meckel's diverticulum, the mucous membrane usually resembles that of the intestine where it is situated. The presence of gastric mucosa was first described by Deetz in 1907 and Denecke reported the first ulcer in Meckel's diverticulum in 1902. Schaetz in a study of 30 diverticula found 50 per cent contained abnormal elements, such as pancreatic tissue and gastric mucosa. Huebschmann found ulcers in the Meckel's diverticulum to be like jejunal ulcers. Schaaff found that the fluid content of the diverticulum with gastric mucosa contained greater acidity and this observation was confirmed by Lindau and Wulff (1931). Cobb in 1936 collected 100 cases of Meckel's diverticulum of which 66 showed positive evidence of presence of gastric mucosa. The clinical symptoms of Meckel's diverticula containing gastric mucosa with ulcer formation generally included pain, or intestinal hæmorrhage and in some the patients sought admission for perforation.

The following case illustrates a case of acute abdomen due to perforation of Meckel's diverticulum with no previous history of pain, colic or intestinal hæmorrhage. It was very sudden and ended in recovery.

A Hindu male, aged 35 years, was admitted in 1936 for the treatment of severe pain in the lower part of the abdomen, of nearly 22 hours' duration. He stated he had no colic or pain at any time. He enjoyed good health prior to this occurrence. It started suddenly as a colic after a heavy meal with subsequent pain referred to the umbilical region. With this colic and pain he walked a distance of nearly two miles. After reaching home, he developed nausea and vomited three times, bringing out undigested food. He was given an enema twice without any result. On admission his general condition was found to be good, temperature 99°F., pulse 96 per minute with good volume and tension, and respirations 22 per minute.

*Local condition.*—Abdomen in the lower part moved freely with respiration. Abdominal wall was not rigid but was tender in the umbilical region. Bubbling and gurgling sounds were heard. Urine was found to contain plenty of acetone but no sugar. Blood sugar was within normal limits. He was treated as a case of appendicitis and watched. Seven hours after admission, the abdomen became distended with increase in pulse rate causing great discomfort. Perforation of appendix with peritonitis was suspected and an operation was decided upon and done.

Under spinal anaesthesia, abdomen was opened through a right para-median para-umbilical incision. On opening the abdomen free fluid was found in the peritoneal cavity with flakes of lymph. Suction was used to drain this fluid out. The coils of small intestines were found distended. An appendix-like organ was found fixed to the anterior abdominal wall underneath the umbilicus which on exploration proved to be a Meckel's diverticulum. There was a small mesentery attached to it. A loop of small bowel was kinked over the proximal part of the attachment of the diverticulum to the small intestine. On freeing the intestine, exploration of the diverticulum revealed a perforation in its mesenteric border about its middle. The diverticulum was excised after crushing it at the root, as in an appendix operation, the stump was

PLATE XVII

Electro-cardiogram of cases who showed diastolic murmur.



Fig. A. Case 2.

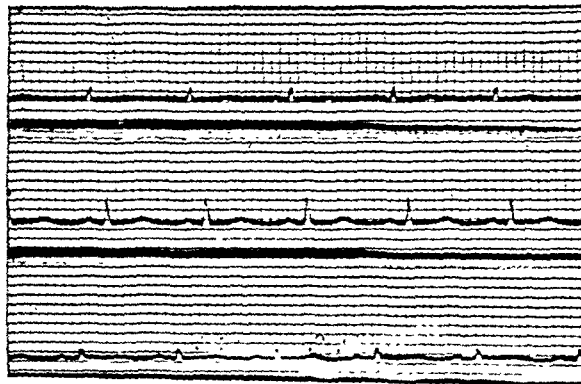


Fig. B. Case 10.

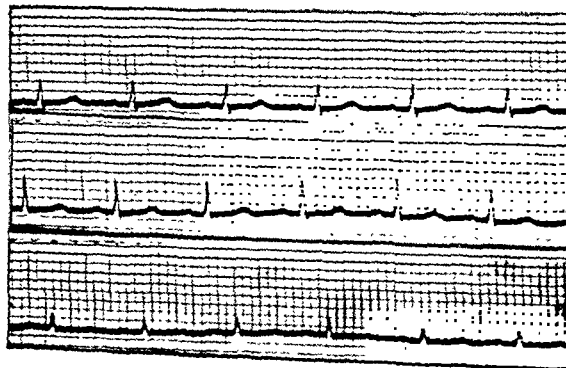


Fig. C. Case 22.

PLATE XVIII  
Teleradiogram of cases who showed diastolic murmur.

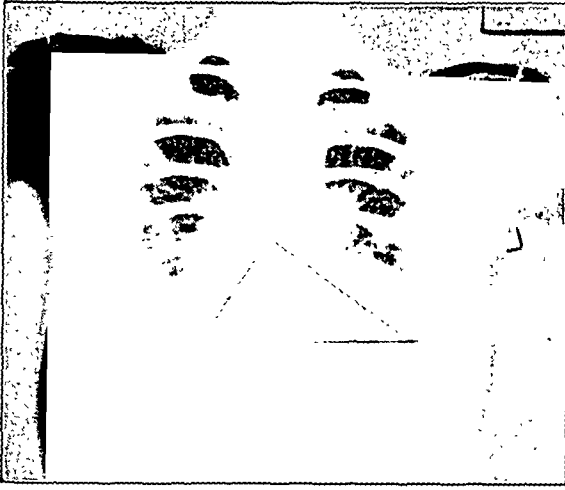


Fig. 1. Case 2.

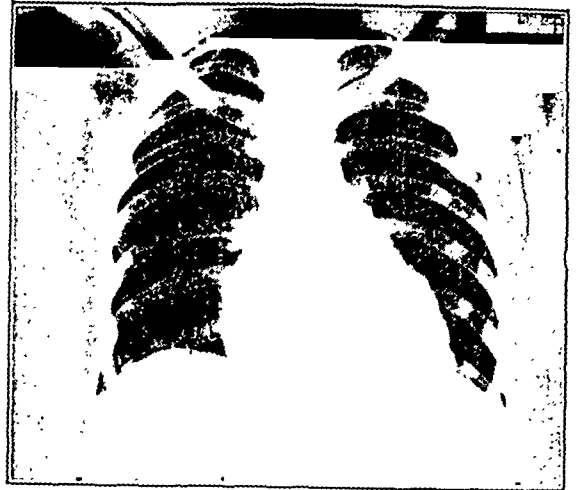


Fig. 2. Case 10.

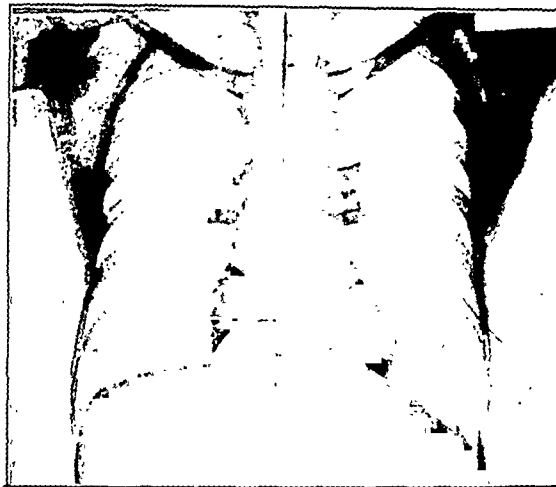


Fig. 3. Case 22.

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PERFORATION OF A MECKEL'S DIVERTICULUM WITH GASTRIC MUCOSA : M. G. KINI

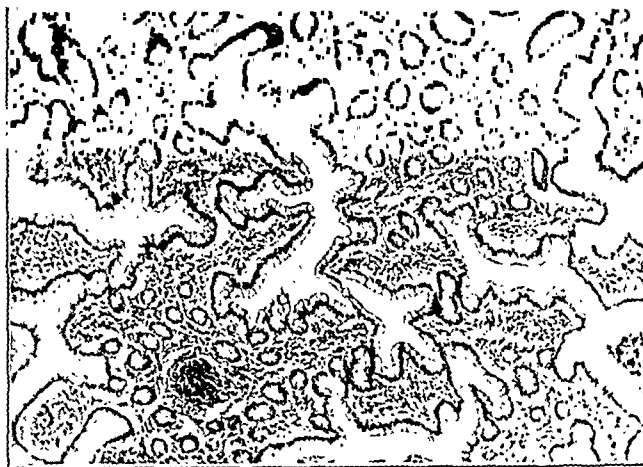
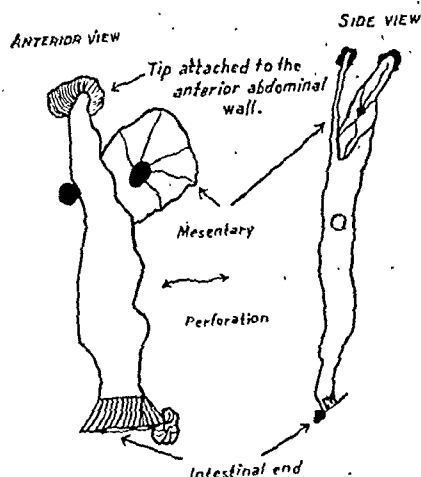


Fig. B is a photomicrograph showing the structure of a gastric mucous membrane in the Meckel's diverticulum.

ligatured, and the raw area was covered by a few lembert sutures. The abdomen was closed in layers with three drains: one in the recto-vesical pouch, one in



Figs. A1 and A2 are line drawings showing the actual size of the Meckel's diverticulum removed at operation. Note the perforation.

front of the anterior superior iliac spine draining the right para-colic gutter, and one in front of the left anterior superior iliac spine draining the left para-colic gutter.

The patient made an uneventful recovery.

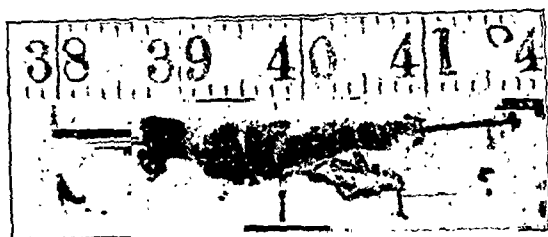


Fig. C is a photograph of the specimen removed.

#### Pathological report

Histo-pathological examination showed a catarrh of the mucous membrane and in places papillomatous hypertrophy of the villi. The submucous area was found to be oedematous and the vessels were found engorged. No inflammatory cell infiltration was found. The section shows the presence of gastric mucosa of the pyloric end. No pancreatic tissue was seen (plate XVIII, fig. B).

The patient has been followed for four years and is keeping fit with no after effects after the acute perforation.

#### Points of interest

(1) A small appendix-like Meckel's diverticulum which simulated clinically an acute appendicitis with perforation is described. The operation was performed 29 hours after the onset of acute symptoms, with good results. Four years after operation the patient reports normal good health.

(2) The histo-pathological section showed gastric mucosa in Meckel's diverticulum and this was probably the cause of an acute perforation.

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## MULTIPLE PRIMARY EPIDERMOID CARCINOMA

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ALTHOUGH multicentric growths are reported from time to time, their occurrence is rare and the subject is still of great interest. In the year 1869, Bilioth reported the first case of multiple tumours. Lately, Kirshbaum and Shively (1938) gave an excellent review of the earlier recorded cases and reported 25 additional cases of multiple primary malignant tumours, collected from over ten thousand consecutive autopsies. Thomas (1940) reported a case of dual cancer of the stomach. Lamson (1940) reported 2 cases of multiple primary carcinoma. The incidence of such neoplastic tumours has an important bearing on the theory of the mode of origin of new growths. The workers who advocated the 'cell-rest' theory of carcinoma utilized the occurrence of multiple primary tumours for their support. Others who postulated some constitutional disturbance, or a generalized lowering of resistance, as essential for the formation of a neoplasm, quoted the concurrent growth of two tumours as evidence of such a change (Kettle, 1925). Multiple primary neoplastic disease has also been brought into the controversy regarding the question of immunity in tumour formation. The occurrence of one tumour is regarded as affording immunity against further primary growths.

We have come across 2 cases of multiple primary epidermoid carcinoma, which, in the light of the aforesaid, we consider to be a fact worth recording.

*Case 1.*—E. S., male, aged 60 years, a retired seafaring man, was admitted into the hospital on 9th January, 1933, with a provisional diagnosis of rodent ulcer of the face.

*History.*—Six years ago after a short febrile attack, a small abrasion-like area for which he could not give any cause appeared on the right side of his forehead. The area was covered with dry skin. It was picked off but after a few weeks the dry skin reappeared. A few weeks later another small area like the previous one, appeared on the right side of the lower jaw. He

(Continued from previous column)

My thanks are due to Dr. T. Bhaskara Menon, Professor of Pathology, Andhra Medical College, Vizagapatam, for the photomicrographs and the pathological report.

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used to take off the dry skin from those patches but they reappeared. This sort of thing continued for about two years. In the meantime, another area similar in nature appeared behind and below the left ear. He took x-ray treatment for those patches in England. As a result of the x-ray treatment both the areas on the forehead and the jaw disappeared, but the patch on the forehead reappeared after a month. About two months before his admission a large fungating ulcer appeared on the left side just in front of the left ear.

Family history showed no incidences of malignant diseases. The patient smoked about twenty cigarettes a day and was a moderate drinker.

*On examination.*—Small pigmented areas were found all over the body, most marked on the upper part of the body and extremities. On the right side of the forehead there was a swelling, the top of which was ulcerated. The ulcer measured about  $1\frac{1}{2}$  inches by 1 inch in size. The adjacent area surrounding the swelling showed slight flattened bossing. From the base of the ulcer slight serous discharge was found to occur. The tumour was fixed to the deep structures (figure 1). On the left zygoma, an ulcer of the size of a rupee was seen. It was seen to be raised above the surrounding skin. The base of the ulcer was composed of granulation tissue and there was pus and serous discharge from the ulcer (figure 2). No glandular enlargement could be seen. No other abnormal findings were elicited, on physical examination. Blood examination showed a moderate degree of anaemia. Urine and stool were found to be normal. Blood—Wassermann reaction negative. Scrapings from the ulcerated areas were examined by the dark-ground method with negative result. On several occasions blood was examined for microfilaria, but all the examinations were negative. Röntgenological examination revealed several small deficiencies in the right frontal bone. The condition of specific osteoporosis was suggested on radiological grounds. A piece of tissue was cut from the edge of the ulcer of the forehead, which on histological examination showed the typical picture of epidermoid carcinoma (figure 3). The other ulcer on the left zygoma was also similarly examined and the same picture was obtained. He obtained his discharge from the hospital and was subsequently re-admitted on 8th November, 1934, with the above conditions in a much aggravated form. Further histological examination of the ulcers showed the structures of an epidermoid carcinoma. In these sections cell nests were absent and the cells were more embryonic in nature with marked differentiation (figures 4 and 5).

The patient went downhill and expired from the effects of cachexia on 6th June, 1935, without any further detailed history with regard to the presence of metastases elsewhere being elicited.

*Case 2.*—S., aged 45 years, cultivator by occupation, inhabitant of Muzaffarpur district, came with the complaint of a number of lumps with ulcers on his body.

*On examination.*—A tumour the size of a small coconut with a diameter of 4 inches at the top was seen just below the left axilla, occupying the space between the anterior axillary fold and the mid-axillary line. The top of the tumour was found to be ulcerated. The tumour was hard to the touch and was movable from the surrounding structures. The movement of the hand was not impaired. An ulcerated area (figure 6) was seen on the lateral aspect of the middle of the left leg. It was 2 inches in diameter and was found to be situated on an area raised from the general surface of the skin (figure 5). A third tumour, 2 inches in diameter, was found on the back in the middle line, at the level of the 2nd and 3rd lumbar vertebrae (figure 6); it was ulcerated. The tumour in the axillary region was of 5 months' duration. A month after the appearance of this tumour, the ulcerated area on the leg appeared which was soon followed by the ulcer on the back. Besides these there were a number of small ulcerated areas on the back and arms (figure 7). There was no involvement of the regional lymph glands. The patient had been an albino since his birth. There were many melanotic areas on the depigmented skin and at

several places there were areas of keratosis. From the nature of the ulcerated tumours, a malignant process was suspected and pieces from all the three areas were cut and examined histologically. All the three showed the typical appearance of an epidermoid carcinoma (figure 8). The patient refused hospital treatment and left for home. His subsequent history could not be obtained.

*Comment:* There are several points which are to be considered before one can conclude the primary nature of a multiple neoplastic condition. There are divergent opinions as to the criteria of the above. Lamson (1940) quoted Goetze's suggestion of what should be the criteria to establish the primary nature in the case of multiple carcinoma; according to Goetze the tumour must have the macroscopic and microscopic appearance of usual tumours of the organs involved, and exclusion of metastasis must be certain. Billoth laid down that, (1) each tumour must have a different histological appearance; (2) the tumours must have different sites of location; and (3) each tumour must produce its own metastasis. Again Wooley's (1903) opinion was that the multiple primary tumours (1) may affect the same tissue and produce identical tumours or growths of different types; (2) may affect both of a pair of organs but that need not necessarily be of the same histological type, e.g., both breasts; (3) may affect different regions of the same system, not necessarily of the same histologic type, i.e., the genital tract; (4) different systems may be affected by different types of new growths. If Goetze's contentions are accepted the two cases reported above are found to fulfil the conditions. The microscopic appearances of these (as seen in figures 3, 4 and 5) are quite characteristic of epidermoid carcinoma. Malignant epithelial tumours of the skin are never known to produce metastases in another part of the skin. Moreover, in both the above cases, the appearance of the second focus of tumour formation was almost simultaneous with the first one. In the first case, the second growth appeared after a few weeks, and, in the second case, the second patch showed itself after a month. Our two cases fulfil Billoth's second condition, but here Billoth's first condition cannot be applied, because in our cases the nature of the tumour and the tissue were the same. None of the cases showed any lymphatic glandular involvement when they came first under our observation, although multiple new growths were conspicuous. Hence, taking all the above points into consideration, it seems reasonable to conclude that both cases can be taken as instances of multiple primary growths occurring in the skin. In Kirshbaum and Shivley's (1938) series, they reported 25 cases of multiple primary carcinoma involving most of the organs, but not in a single case was the skin found to be involved. As to the ætiological factors, we could get no indication as to the

(Continued at foot of opposite page)

PLATE XIX  
MULTIPLE PRIMARY EPIDERMOID CARCINOMA: DE AND TRIBEDI



Fig. 1. Case 1.—Photograph showing the site and nature of the tumour.

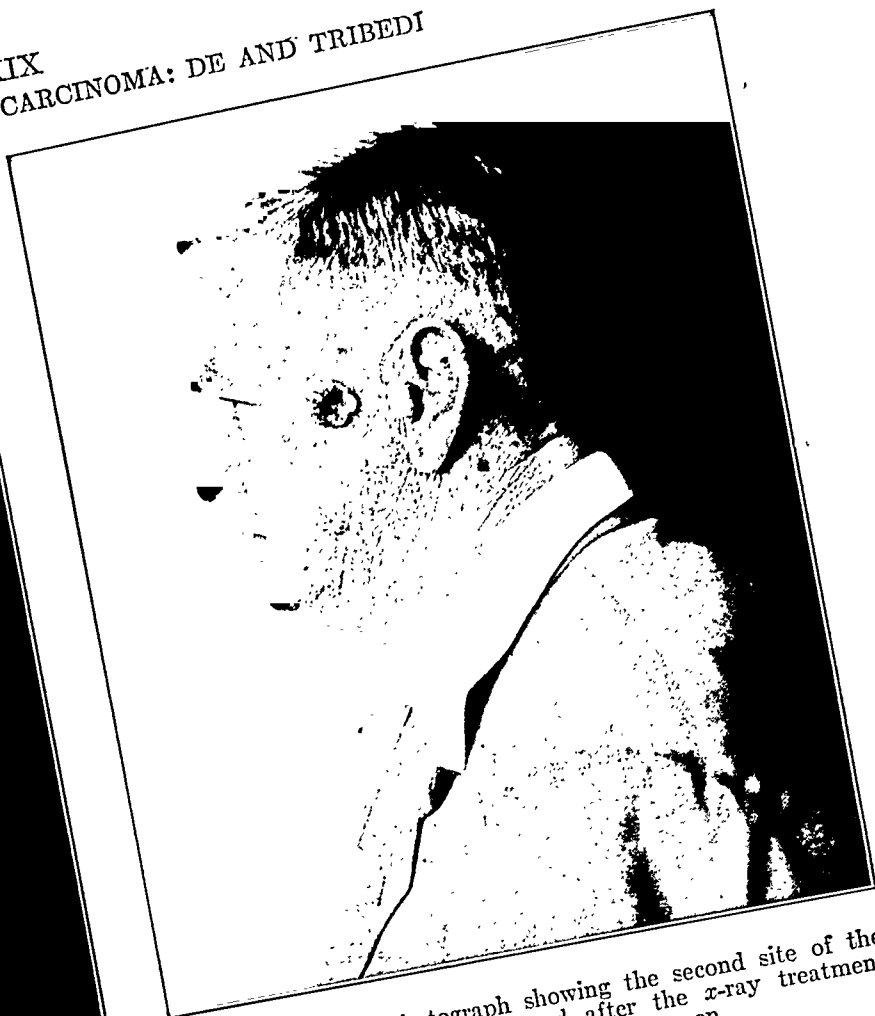


Fig. 2. Case 1.—Photograph showing the second site of the tumour. The scar tissue formed after the x-ray treatment below the left ear could be seen.



Fig. 3. Case 1.—Photomicrograph of a piece of tissue from the growth of the forehead. The picture is typical of an epidermoid carcinoma with marked cell nest formation.  $\times 150$ .



Fig. 4. Case 1.—Photomicrograph of a piece taken after 8th November, 1934, from the forehead. An epidermoid carcinomatous condition is evident but cell nests were absent and cells were more embryonic than seen in figure 3.  $\times 150$ .





Fig. 5. Case 1.—The same as the above under higher magnification to show the marked differentiated condition of the squamous cells.  $\times 420$ .



Fig. 8. Case 2.—Photomicrograph of a piece of tissue removed from the axillary tumour. Epidermoid carcinomatous condition of the tumour is clear. Cells are well differentiated.  $\times 70$ .



Fig. 6. Case 2.—Photograph of the patient showing both the tumour areas.

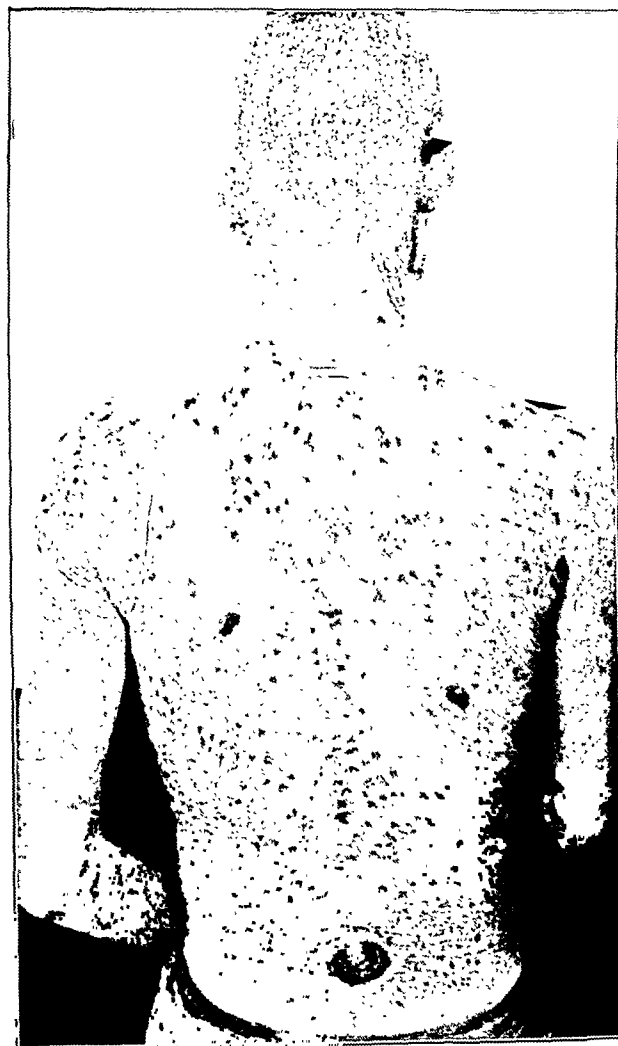


Fig. 7. Case 2.—Photograph of the same patient showing the third site of the tumour. Note the general pigmented condition of the skin with numerous melanotic areas scattered all over. Two small black coloured ulcerated areas one at either side of the middle of the back are also seen.

Fig. 7.

## THE ARNETH COUNT IN THE TROPICS

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*The Arneth count.*—The neutrophilic polymorphonuclear leucocyte is derived from a mononuclear cell (myelocyte) with a single round nucleus. The myelocyte passes through an intermediate stage with a single indented nucleus (metamyelocyte). It is evident therefore that the cell with a simple round nucleus is younger than that with an indented nucleus and this form is younger than the true polymorphonuclear cell. Arneth (1904), following this line of thought, argued that a polymorphonuclear cell with only one lobe was younger than one with two lobes and so on. The work of Colbert (1924), Ponder (1924 and 1926), Charipper (1928) and Hunt and Weiskotten (1930) has produced experimental evidence in favour of Arneth's theory regarding the age of the polymorphonuclear leucocyte and conformation of the nucleus.

Arneth divided polymorphonuclear cells into five main classes, the division being based on the number of the nuclear lobules. He counted one hundred polymorphonuclear cells and arranged them in his five classes like this:

I	II	III	IV	V
5	35	41	17	2

Cells in the different classes were further subdivided according to the morphology of the nucleus. Arneth stated that the percentage of cells in the various classes varied only within normal limits in health, but changed in infectious conditions, the change usually being in the direction of an increase in the percentage of classes I and II and a decrease in classes III, IV and V; this he spoke of technically as a 'shift to the left'.

(Continued from previous page)

possibility of chronic irritation as the predisposing cause in either of the cases. It seems reasonable that in both the cases the epidermis had the natural genetic tendency to proliferate in an atypical way. It is unfortunate that we were not able to study the cases more closely, especially with reference to any metastases that may have been present.

Lastly, our thanks are due to the Surgeon Superintendent, Presidency General Hospital, Calcutta, for the record of the first case.

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*The polynuclear count.*—Cooke (1914) simplified and modified the Arneth count by doing away with the subdivisions in the classes and by giving a criterion of nuclear lobulation—'If there is any band of nuclear tissue except a chromatin filament connecting the different parts of a nucleus, the nucleus cannot for the purpose of Arneth count be said to be divided'. When the count is done according to this criterion Cooke and Ponder (1927) call it the 'polynuclear count'.

*The weighted mean of the count.*—In Arneth's count the result is expressed in five sets of figures, which is rather cumbersome, and it was desirable to replace such an expression by a single figure. Many ways of doing this have been suggested. The best method appears to be to express the count in terms of weighted mean as suggested by Ponder and Flinn (1926). The cells of each group are multiplied by the number of the group (group I by 1, group II by 2 and so on), the results added, and the total divided by the number of cells counted; this gives the weighted mean.

*Normals.*—Cooke and Ponder (1927) examined ninety healthy individuals carefully selected to exclude the presence of any focus of infection and obtained the following average:—

I	II	III	IV	V
10	25	47	16	2

The average weighted mean of their series is 2.74 and they are of opinion that the weighted mean of the count in a healthy individual should not be less than 2.4.

Kennedy (1933) examined ninety healthy students not so rigidly selected; the average weighted mean of his series is 2.628 and the standard deviation 0.19. The nearest count corresponding to this mean was:—

I	II	III	IV	V
13	30	43	10	4

*Local variations of the count.*—There is some evidence to show that the average polynuclear count varies according to locality. Abels (1934) examined one hundred healthy individuals in New York; he obtained an average weighted mean of 2.3 which is lower than the mean of Cooke and Ponder in England (2.74) and of Kennedy in Scotland (2.628). MacLeod (1935) made polynuclear counts on blood films obtained from widely scattered localities. He concludes that his figures indicate that definite differences exist between the means of various localities.

*Variations of the count in the tropics.*—Marked variations in the counts from the standards laid down in Britain have been reported in healthy individuals in tropical and subtropical countries (tables I and II). Chamberlain and Vedder (1911) found a marked 'shift to the left' in Filipinos and a slight shift in the same

TABLE I

*The Arneth counts in Philippines, Australia and West Africa compared with standards of Arneth in Europe*

Locality	Nationality	Number of cases	Worker	Average Arneth count					Average Arneth index (sum of I and II)
				I	II	III	IV	V	
Europe ..	Europeans	..	Arneth (1904)	5.0	35.0	41.0	17.0	2.0	40.0
Philippines ..	Filipinos	50	Chamberlain and Vedder (1911).	27.5	38.3	25.8	7.5	0.9	65.5
	Americans			13.3	32.9	37.2	14.6	2.0	46.2
New Guinea ..	Native adults.	104	Breinl and Priestley (1914 to 1916).	30.04	44.0	21.23	4.3	0.48	74.04
	Native children.	50		42.96	40.9	13.8	2.13	0.21	83.86
North Australia	Australian children.	39		25.8	45.8	23.3	4.8	0.3	71.6
North Queensland	European children.	150		32.5	42.0	20.6	4.5	0.4	74.5
West Africa ..	Natives	20	Macfie (1915)	17.17	38.75	34.22	9.15	0.75	55.92
	Europeans	29		11.4	40.2	36.7	10.7	1.0	51.6

TABLE II

*The polynuclear counts in India, Iraq, China, Egypt and Syria compared with the standards of Cooke and Ponder and of Kennedy*

Locality	Nationality	Number of cases	Worker	Average polynuclear count					Weighted mean	
				I	II	III	IV	V	Average	Standard deviation
Wigan (England).	British	90	Cooke and Ponder (1927).	10	25	47	16	2	2.74	0.180
Edinburgh (Scotland).	British	90	Kennedy (1933).	13	30	43	10	4	2.628	0.190
Calcutta (India).	Bengalees	100	Banerji (1924).	20.75	31.8	32.9	12.8	1.75	2.43	..
Iraq ..	Iraqi	134	Kennedy and Mackay (1935 and 1936).	26	51	21	2	0	1.994	0.273
	British	405		23.7	60.6	14.4	1.1	0.2	1.935	0.222
Moukden (China).	Chinese	42	Pai (1935 and 1936).	26.7	43.7	25.4	4.0	0.2	2.073	0.178
	British			32.6	41.2	23.0	3.1	0.1	1.969	..
Egypt ..	Egyptian	50	Shaw (1936)	25	42	29	4	0	2.128	0.148
	British	30		27	43	46	4	0	2.077	0.135
North Syria	Alouites	326	Shanklin (1936).	58.93	35.42	5.04	0.56	0.08	1.48	0.04
Calcutta (India).	Indians	50	Author	30.49	42.75	21.76	5.02	0.01	2.014	0.132

direction in Americans living in the Philippines. Breinl and Priestley (1914, 1915, and 1916) found a marked 'shift to the left' in healthy white school children in tropical Queensland, in

native adults and children in New Guinea, and in native children in northern Australia. Macfie (1915) found a slight 'shift to the left' in natives of West Africa and in healthy

Europeans living there. Banerji (1924) found a 'shift to the left' in healthy Bengalees. Kennedy (1935) found a marked 'shift to the left' in the polynuclear counts of natives of Iraq, the weighted mean being 1.98. Kennedy and Mackay (1935 and 1936) found a marked 'shift to the left' in the polynuclear counts of British airmen and officers stationed near Baghdad, the average weighted mean being 1.94. Pai (1935 and 1936) found a marked 'shift to the left' in the polynuclear counts of healthy Chinese and of British residents in Moukden. Shaw (1936) found that the polynuclear counts of healthy Egyptians and of British subjects domiciled in Egypt showed a significant 'shift to the left'. The average weighted mean in Egyptians was 2.128 and that in British subjects in Egypt was 2.077. Shanklin (1936) found a marked 'shift to the left' in the polynuclear counts of the Alouites, the average weighted mean being 1.48.

*Present work.*—Fifty healthy Indians, all males, were examined in the beginning of June 1937. The age in the majority of cases varied between 20 and 40, only in five cases was it above 40. All the specimens were collected within five days and were obtained between 10 a.m. and 12 p.m. The maximum shade temperature during these days varied between 93.6° and 97.4°F. The subjects comprised doctors, technicians and laboratory assistants at the Calcutta School of Tropical Medicine. No individual who had had a cold or other minor illness during the past one month or had any degree of pyorrhœa was included in the series.

*The technique.*—Smears were made with the blood obtained from a finger prick on scrupulously clean slides. The films were dried in air, fixed in methyl alcohol, and stained with hæmatoxylin and eosin. The staining is done as follows:—The fixed smear is stained with Delafield's hæmatoxylin solution for 3 to 5 minutes. The slide is washed well in water and as a counter-stain a 0.5 per cent watery solution of eosin is applied for a minute or so. The slide is again washed, dried and examined. One hundred cells were counted in each slide and Cooke's criterion about nuclear lobulation was strictly adhered to, the nuclear parts joined by more than a thread being considered as one. Free nuclei and cells with distorted nuclei were rejected.

*Results.*—The results of these examinations are presented in table III. The last column of the table gives the weighted means of the counts calculated by the method of Ponder and Flinn. These means vary between 1.80 and 2.37, the average being 2.014 with a standard deviation of 0.132. The highest number of observations occurred between 1.90 and 1.99. A comparison of our findings with the findings of other work (table II) brings out the following points:—

(1) Our average weighted mean of the count is significantly lower than the average mean for England, Scotland and Egypt. The difference from the Egypt figures not being marked.

(2) It does not differ significantly from the average weighted mean for Iraqis and Chinese.

(3) It is significantly higher than the average weighted mean for British in Iraq and China and for the Alouites. Only in the case of Alouites is the difference very marked.

The observations therefore show that compared with the standard in Britain there is a marked left-handed shift of the Arneth count in Calcutta, as in other tropical countries where such studies have been made. The extent of the shift may vary in the different countries.

*Possible causes of the variation in the count.*—A left-handed shift of the count can be produced either by an over-stimulation of the bone-marrow, whereby younger cells are added in greater numbers, or by an accelerated removal of the polymorphonuclear cells from the circulation, whereby the cells are removed before they attain maturity. If only one of the factors operate the result will be to produce an unsteady state of the count as the steady state of the polynuclear count is the result of a balance between the rate of production of the polymorphonuclear cells and the rate of their removal from the circulation. The left-handed shift found in the tropics is thus suggestive of both bone-marrow stimulation and accelerated removal of the polymorphonuclears from the circulation.

Nothing is known about the causes that shorten the life of a polymorphonuclear cell in the circulation. As regards the other factor it is known that thyroid feeding, benzol injections, x-rays and ultra-violet exposures, microbial infections, etc., stimulate the bone-marrow and bring about a left-handed shift in the Arneth count.

Since microbial infection was the first known cause of a marked left-handed shift in the Arneth count, it was natural that at first there was a tendency to attribute the left-handed shift observed in apparently healthy individuals in the tropics to active or latent infections of a minor degree, e.g., oral sepsis, chronic intestinal infections, malaria, etc. Macfie (1915) found a well-marked shift to the left of the Arneth count in patients with malaria. This led him to believe that the left-handed shift found in healthy people in the Philippines (Chamberlain and Vedder), tropical Australia (Breinl and Priestley), and West Africa (Macfie) was due to the fact that these apparently healthy individuals were suffering from an inapparent infection with malarial parasite. Breinl and Priestley did not subscribe to this view *in toto*, as they obtained marked left-handed shift in the Arneth counts of children in North Australia in whom malaria could be excluded. Kennedy (1935) at first thought that the left-handed shift encountered in the natives of Iraq might possibly be accounted for by widespread diseases not severe enough to make the patient feel unwell. His later work with Mackay, however, showed that the climatic conditions appeared

to be the determining factor. Kennedy and Mackay (1935 and 1936) found that the British airmen living in Iraq showed nearly the same amount of left-handed shift in the polynuclear

tion is very high; the admission to the Royal Air Force is made after a rigorous medical examination and all the subjects had good health records.

TABLE III  
*Polynuclear counts of 50 healthy Indians*

Number	Age	Polynuclear count					Weighted mean
		I	II	III	IV	V	
1	37	17	40	33	9	1	2.37
2	32	30	60	10	..	..	1.80
3	30	21	38	34	7	0	2.27
4	31	28	49	21	2	0	1.97
5	44	40	42	16	2	0	1.80
6	32	27	41	30	2	0	2.07
7	27	33	44	19	4	0	1.94
8	20	38	40	19	3	0	1.87
9	41	29	43	23	5	0	2.04
10	20	34	43	21	2	0	1.91
11	27	38	37	20	5	0	1.92
12	34	29	38	28	5	0	2.09
13	32	26	44	25	5	0	2.09
14	31	36	39	21	3	1	1.94
15	38	32	35	27	6	0	2.07
16	25	34	40	23	3	0	1.95
17	24	28	35	30	5	2	2.18
18	27	32	30	28	7	3	2.19
19	21	29	44	21	6	0	2.04
20	26	36	40	22	2	0	1.90
21	24	26	36	34	4	0	2.16
22	28	35	45	16	3	1	1.90
23	23	24	50	20	6	0	2.08
24	22	22	44	30	4	0	2.16
25	25	30	50	18	2	0	1.92
26	26	20	46	30	4	0	2.18
27	35	35	38	21	6	0	1.98
28	35	20	50	26	4	0	2.14
29	35	35	45	18	2	0	1.87
30	20	40	34	22	4	0	1.90
31	40	42	35	18	5	0	1.86
32	20	30	46	20	4	0	1.98
33	26	30	50	19	1	0	1.91
34	30	35	40	20	4	1	1.96
35	29	38	38	20	4	0	1.90
36	29	35	43	20	2	0	1.89
37	28	36	40	20	4	0	1.92
38	38	34	45	17	4	0	1.91
39	39	35	40	23	2	0	1.92
40	34	35	37	22	6	0	1.99
41	29	30	40	26	4	0	2.04
42	25	25	45	25	4	1	2.11
43	30	33	38	23	6	0	2.02
44	46	33	40	23	4	0	1.98
45	48	30	40	24	6	0	2.06
46	34	20	40	28	12	0	2.32
47	38	35	38	23	4	0	1.96
48	34	21	38	32	9	0	2.29
49	40	32	33	30	5	0	2.08
50	44	38	36	22	4	0	1.92
Total ..	..	1,551	2,062	1,161	216	10	..
Average ..	..	31.02	41.24	23.22	4.32	0.20	2.014 ± 0.132
Smoothed values ..	..	30.49	42.75	21.76	5.02	0.01	2.014 ± 0.132

count as did the natives of Iraq. The question of pathological stimuli could be excluded in this population as the health standard of the popula-

Next to infection comes the consideration of the racial factor. Whether this left-handed shift in the count in the tropics as compared

with the standards in England has anything to do with racial differences? The earlier work of Chamberlain and Vedder, of Breinl and Priestley and of Macfie and the recent work of Kennedy and Mackay, of Pai and of Shaw gives a reply to this question in the negative.

The possibility of the differences in the counts being due to the differences in the diet does not seem to be a probable one, as the diet of British residents in China, Iraq and Egypt approximates very closely to that in England.

The fact that the count of British residents in China, Iraq and Egypt conforms to that of the inhabitants of the respective countries indicates that the difference is environmental in origin. The studies on the changes in the count produced by change of residence support this view. Pai (1935) reported a change in the counts with change of residence in two Chinese. In China, the counts were of the Chinese type, there being a marked left-handed shift, but a residence in England changed the counts to the English type. Shaw (1936) reports similar changes. Two British subjects who had been in Egypt for eight months had a count of the Egyptian type. The counts assumed the British type on their return to Europe and conformed to that type throughout their residence in that country. When they again returned to Egypt the counts once more assumed the Egyptian type.

What are the environmental factors that are common to the tropical countries in which the count has been studied? It has been suggested by Chamberlain and Vedder, Breinl and Priestley, Pai, Kennedy and Mackay that climate may be responsible for the differences observed. Kennedy and Mackay consider that ultra-violet radiation was probably an important factor. Kennedy and Thompson (1929) found that by an exposure to ultra-violet rays the Arneth count in rabbits was deflected to the left. Kennedy (Kennedy and Mackay, 1935) found that exposure to the intense dry heat of a Turkish bath caused a significant left-handed shift. Both heat and ultra-violet radiation are thus capable of effecting a left-handed shift and are, no doubt, a common environmental factor in tropics, but it appears that these factors as such are not the determining factors. Pai (1935) found that the polynuclear counts in healthy Chinese in summer showed a less marked left-handed shift than those in the winter. Again Pai's results for Chinese (average weighted mean 2.05) during the cold and dry winter in China do not differ significantly from Kennedy's results for Iraqis (average weighted mean 1.994) examined in Iraq during the months of June and July when the maximum shade temperature varied from 98° to 116°F. Shaw's figures for British subjects in Egypt (average weighted mean 2.077) examined during winter when the maximum shade temperature varied from 65° to 81°F., although significantly different from

Kennedy and Mackay's figures for British subjects in Iraq (average weighted mean 1.937) examined in May and June when the maximum shade temperature varied between 100° and 115°F. do not show that marked difference which one would expect to find if tropical heat were the sole factor in bringing about a change in the Arneth count. As regards the ultra-violet radiation no work has been done to correlate the degree of the left-handed shift in the count with the amount of exposure of the subject to such radiation.

It would thus appear that not much is known about the environmental factor or factors which are responsible for the left-handed shift in the polynuclear counts in the tropics and the way in which they produce this change. Danzer (1930) found that injections of extracts of different tissues of hæmolyzed red cells and of leucocytes, and the destruction and absorption of tissues *in vivo* in rabbits was followed by a deflection of the Arneth count to the left. He suggested that the continual and normal breakdown of the tissues in the body was sufficient to provide a stimulus for the continuous and normal output of polymorphonuclear cells from the bone-marrow. Thus it is probable that the rate of destruction of leucocytes and their removal from the circulation, along with other factors, exercises a control on the production of these cells in the bone-marrow. It might be that accelerated removal of the polymorphonuclears from the circulation is primarily responsible for the left-handed shift and the stimulation of the bone-marrow is a secondary factor. If it were shown that the length of life of a polymorphonuclear cell is shortened in tropics, a step forward would be taken in explaining the left-handed shift found in these countries. The next thing would then be to search for the factors in tropical climates that shorten the life of the polymorphonuclear cell.

### Summary

1. The Arneth counts in fifty healthy Indians are reported.
2. The average weighted mean is 2.014 with a standard deviation of 0.132.
3. This average mean is significantly lower than the normal standards laid down in Britain. On the other hand, it is similar to the findings reported from other tropical countries, e.g., Iraq, China and Egypt.

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## THE ARNETH COUNT IN NORMAL INDIANS

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**Subjects.**—In all, 50 men were examined. Any man who was performing his usual work and did not give a history of a recent illness was taken as normal.

Of the 50 people examined, 30 were workers from the School, viz, doctors, chemists and laboratory assistants, and the remaining 20 were doctors from the D. T. M. class of the School.

The majority of the subjects were Bengalis, only 6 out of 50 were from outside the province of Bengal; of these 4 were from the Punjab and one each from United Provinces and Rajputana.

Their ages varied from 26 to 50 years, but the majority were under 40 years of age.

**Technique.**—Very thin smears were made on rouge-polished slides; the slides were dried immediately and stained with May-Grünwald and Giemsa stains (Napier and Das Gupta, 1940).

In counting the nuclear lobes, Cooke's criterion of differentiating the lobes was strictly followed and in the case of any doubt about the lobes in cells of class V, IV, and III, they were always put into the next lower class (Napier and Das Gupta, 1941).

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In every case nuclear lobes of 100 neutrophilic cells were counted.

**Discussion.**—It will be seen from table I that in most cases there is predominance of cells of class I, over 40 per cent of cells of this class being present in as many as 21 cases, and along with this there is paucity of cells of classes IV and V; in only five instances were cells of class V seen in a total of 50 cases. Consequently the weighted mean is very low in most cases; in only 10 cases is the weighted mean above 2.0, and in no cases is it above 2.3. The average 'weighted mean' of the whole series is only 1.84, for the 44 Bengalis 1.82, and for the 6 non-Bengalis 1.96, whereas Cooke and Ponder's (1927) average weighted mean for normals is 2.75. Dharmendra (1941), working among the same class of people as ours, found an average weighted mean of 2.014.

The slightly higher figure obtained by Dharmendra is probably due to the mode of staining. For, while we used the May-Grünwald and Giemsa stains with very satisfactory results, Dharmendra used the hæmatoxylin stain, with the result possibly that many of the bi-lobed eosinophils could not be differentiated from the neutrophils and were consequently classed as cells of class II. The percentage of eosinophils in the average Indian being quite high, it may be assumed that there was an undue increase of cells of class II and consequent raising of the 'weighted mean'. Another reason for the slightly higher value obtained by Dharmendra may be his slightly more rigorous selection of the cases.

Napier, Neal-Edwards and Das Gupta (1941) working among normal Indian women found the same preponderance of young cells and a low 'weighted mean'; the average 'weighted mean' of the whole series being 1.77.

A low 'weighted mean' was also found by almost all observers examining the blood of the people in the tropics, a comprehensive list of which is given by Dharmendra in his article in the present number.

Though in the selection of the cases no rigorous method was employed, as was done by Cooke and Ponder, it will be seen from table II that there was not a single case with a weighted mean above 2.30. It is impossible to believe that of the 50 apparently healthy people examined, not even a single person could be said to be perfectly normal on the basis of the Arneth count, if Cooke and Ponder's criterion of normality be adopted in the case of the Indians. The difference between the Indian and European figures is probably a racial one, for it will be seen from table I that though the weighted mean is slightly higher in the case of 6 non-Bengalis, there is not much difference between the counts in the Bengalis and non-Bengalis. But on the other hand, whilst examining the blood of a few normal Europeans

living in Calcutta, we obtained figures almost the same as those of Cooke and Ponder though Kennedy and Mackay found almost an identical 'weighted mean' in the Iraqis and in the British airman stationed in Iraq (table III).

It is very difficult to say whether this predominance of the young cells and the consequent lowering of the 'weighted mean' in Indians and in the people of the tropics is

a defence mechanism for the protection of the people from the widespread infection to which they are subjected or whether this is due to the actual presence of a low-grade infection, in these Indians. But, whatever be the cause, in interpreting the result of an Arneith count in an Indian, the low figures obtained among normal Indians should be remembered and the results must always be compared with the

TABLE I

Number	I	II	III	IV	V	Weighted mean	Race
1	49	37	12	2	0	1.67	Bengali
2	43	38	17	2	0	1.78	"
3	30	54	14	2	0	1.88	"
4	48	37	14	1	0	1.68	"
5	49	37	12	2	0	1.67	"
6	52	43	4	1	0	1.54	"
7	33	52	14	1	0	1.83	"
8	39	39	18	3	1	1.88	"
9	44	42	12	2	0	1.72	"
10	38	43	17	2	0	1.83	"
11	37	45	17	1	0	1.82	"
12	47	33	18	2	0	1.75	"
13	64	32	4	0	0	1.40	"
14	45	42	11	2	0	1.70	"
15	35	49	16	0	0	1.81	"
16	24	45	26	5	0	2.12	"
17	29	42	21	8	0	2.08	"
18	18	46	29	6	1	2.26	"
19	42	42	13	3	0	1.77	"
20	33	48	16	3	0	1.89	"
21	54	38	8	0	0	1.54	"
22	36	45	18	1	0	1.84	"
23	24	49	25	2	0	2.05	"
24	19	58	17	5	1	2.11	"
25	39	43	15	2	1	1.83	"
26	49	34	12	5	0	1.73	"
27	27	53	19	1	0	1.94	"
28	55	31	13	1	0	1.60	"
29	35	41	21	2	1	1.93	"
30	27	42	23	7	1	2.12	"
31	22	50	26	2	0	2.08	"
32	32	49	15	4	0	1.91	"
33	24	56	18	2	0	1.98	"
34	40	52	7	1	0	1.68	"
35	41	40	16	3	0	1.81	"
36	35	44	20	1	0	1.87	"
37	32	45	18	5	0	1.96	"
38	18	44	30	8	0	2.28	"
39	48	47	4	1	0	1.58	"
40	52	39	8	1	0	1.58	"
41	20	54	24	2	0	2.08	"
42	48	43	8	1	0	1.62	"
43	56	36	7	1	0	1.53	"
44	62	34	4	0	0	1.42	"
45	34	40	23	3	0	1.95	"
46	34	49	16	1	0	1.84	Punjabi
47	40	41	18	1	0	1.80	"
48	37	38	21	4	0	1.92	"
49	20	44	26	7	3	2.29	"
50	29	47	22	2	0	1.97	Gujrati U. P.
Mean ..	37.9	43.4	16.0	2.5	0.2	1.84	
44 Bengalis ..	38.7	43.5	15.2	2.5	0.1	1.82	
6 Non-Bengalis	32.3	43.2	21.0	3.0	0.5	1.96	

Indian figures and not with the European figures.

TABLE II

Weighted mean	Number
1.4 to 1.49 ..	2
1.5 to 1.59 ..	5
1.6 to 1.69 ..	6
1.7 to 1.79 ..	6
1.8 to 1.89 ..	13
1.9 to 1.99 ..	8
2.0 to 2.09 ..	4
2.1 to 2.19 ..	3
2.2 to 2.29 ..	3
Mean 1.792 $\pm$ 0.203	

*Summary.*—The Arneth count in 50 normal Indians is given. There is preponderance of young cells and consequently a low 'weighted mean'. The 'weighted mean' of the whole series is 1.84, which is much below the average 'weighted mean' of Europeans, and of the people of other western countries.

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TABLE III

Authority : Subjects : Locality			Class					
			I	II	III	IV	V	Weighted mean
Cooke and Ponder (1927)	British; England	..	10	25	47	16	2	2.75
Kennedy and Mackay (1935)	British airmen: Iraq	..	30	49	18	3	0	1.94
	Iraqis	..	26	51	21	2	0	1.99
	Iraqis	..	36	34	25	5	0	1.99
Dharmendra (1941)	Calcutta	..	30.49	42.75	21.76	5.02	0.01	2.014
Napier, Neal-Edwards and Das Gupta (1941), females,	Calcutta.	..	41	44	12	3	0	1.77
Present series, males, Calcutta	..	..	37.9	43.4	16.0	2.5	0.2	1.84

## A NOTE ON FEVERS OF THE TYPHUS GROUP IN ASSAM

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WHILE carrying out routine Widal tests at the Pasteur Institute Laboratory, Shillong, we met from time to time with specimens from patients in Assam whose history suggested enteric fever, but whose serum gave Widal reactions not in the least indicative of that disease, even when repeated two or three times at weekly intervals.

Whilst this, of course, is a common enough experience in any laboratory, it seemed unlikely that failure to produce agglutinins against the enteric group of organisms could entirely account for all the cases of this nature, and in considering other possibilities we noted that the Wilson-Weil-Felix test was rarely, if ever, requested; in fact on only one occasion between 1930 and 1939 was this test asked for. It seemed worth while therefore trying to find out whether some of these cases of 'P. U. O.' might in fact be cases of typhus fever. With this end in view the present investigation was undertaken.

During the course of the investigation, from May 1940 up to date, 203 tests were carried out and the Wilson-Weil-Felix test was considered definitely diagnostic of typhus fever in 17 cases. Of these 17, 8 fell under the head of scrub typhus, 6 probably murine and 3 tick. In none was the Widal in any way suggestive of the enteric group of fevers.

From the geographical point of view the cases can be classified as follows :—

Upper Assam	.. 2	(murine)
Lower "	.. 7	(5 scrub, 2 tick)
Hill Districts	.. 7	(3 scrub, 1 tick, 3 murine)
Surma Valley	.. 1	(murine)

For the purpose of this preliminary investigation the diagnosis of typhus fever is based on a positive Wilson-Weil-Felix test (our criteria being standard agglutination with *B. proteus* OXK at 1/150 or over and with strain OX19 at 1/125 or over), the Widal not suggestive of the enteric group, and the short history sent with the sera.

The highest standard agglutinations (SA) found so far are OXK 1/3,500 and OX19 1/275, the upper limit of agglutination therefore going to dilutions of about 1/6,000 and 1/500, respectively.

The following are examples of typical cases of different races with different grades and severity of disease.

*Case 1.*—Adult Indian male, from the plains. Disease began with malaise, headache and pain in back and limbs. Two days later temperature rose to 102°F. and had risen to 104°F. by the 4th day with daily rise and fall of 2 degrees. He was then toxæmic and looked seriously ill; he was drowsy, delirious at night, and his tongue was coated and dry, and bowels constipated. Bronchial symptoms were present and myocardial weakness developed during the attack. No rash was detected. Temperature fell by lysis to normal on the 14th day. Blood taken on 10th day.

Wilson-Weil-Felix test		
OXK	..	SA at 1/550.
OX2	..	SA at 1/17.
OX19	..	Negative.

*Case 2.*—A young adult Indian female from hills. Toxic with marked delirium and period of coma. Eyes congested, pneumonic symptoms on the 7th day and patient died on 11th day. Temperature fluctuated between 102°F. and 103°F. Blood taken on 10th day.

Wilson-Weil-Felix test		
OXK	..	SA at 1/55.
OX2	..	SA at 1/27.
OX19	..	SA at 1/275.

*Case 3.*—An adult European male, had continuous fever for 18 days which fell by lysis. Headache, some bronchial symptoms, but not very ill. No rash.

Wilson-Weil-Felix test			
	OXK	OX2	OX19
	SA	SA	SA
1. Twelfth day ..	1/400	1/40	1/85
2. One week later ..	1/3,500	1/40	1/85
3. Three months later	1/135	1/27	1/55

*Case 4.*—A young Indian girl, attack began with influenza-like symptoms followed by bronchitis. Blood-stained sputum. No abdominal symptoms. Spleen enlarged 3 fingers. Tongue coated. Temperature swinging in character, fell by lysis in the sixth week. After about 3 days temperature began to show an evening rise (up to 102°F. one evening) lasting about 14 days. No return of bronchial symptoms. No rash was seen.

Wilson-Weil-Felix test			
	OXK	OX2	OX19
	SA	SA	SA
About 28th day of disease	1/800	1/27	1/27
One month later ..	1/275	1/27	1/27

In the absence of any records of typhus fever in Assam, the possibility that this group of diseases might occur and be responsible for a certain number of undiagnosed continued fevers has apparently been lost sight of. The recorded distribution of the typhus group of fevers in India, Burma and Malaya, however, would suggest that Assam is unlikely to be exempt and the findings recorded here would seem to confirm this.

Our thanks are due to Lieut.-Colonel L. A. P. Anderson, I.M.S., Director of the Pasteur Institute, Shillong, for his suggestions and advice during this investigation and for his permission to publish this note.

## PATHOGENESIS OF BRONCHIECTASIS

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*Case report.*—A well-nourished individual, aged 40, was admitted into the tuberculosis ward of the King George Hospital, Vizagapatam, with a history of cough with expectoration, irregular fever, and slight dyspnoea on exertion, of four months' duration. Clinical examination revealed diminished movements, hyper-resonance and diminished air entry over the right side of the chest; with a few moist sounds at the base. Radiography revealed a tumour-like mass near the right hilar region. The lung fields were clear. Fifteen days after admission he developed high fever, and severe cough. X-ray showed at that time a dense patch of opacity at the right base near the cardio-hepatic angle. Atelectasis of the lower lobe or a part thereof was diagnosed. A week later the fever subsided, but the opacity at the base persisted. Lipiodol bronchography revealed well-marked bronchiectasis in the atelectatic portion of the lung. The opacity disappeared in the subsequent radiograph, taken after a month, showing that the inflammation and collapse of the lower lobe had cleared off. There was no evidence of bronchial dilatation either, at that stage.

The case has the following interesting points which afford a clue to the pathogenesis of bronchiectasis :—

- (1) Partial obstruction to the bronchus produced emphysema of the affected lung.
- (2) Defective air entry with possible inflammation produced atelectasis.
- (3) Bronchial dilatation was produced in the atelectatic lobe.
- (4) Dilatation of the bronchioles disappeared when the lobe re-expanded.

*Case report 2.*—Excessive drinking produced a state of temporary mental depression in a naval officer who jumped overboard with the object of committing suicide; but he was rescued by his friends in a few minutes. In those few minutes of partially suspended respiration he had aspirated some sea water into his lungs. When he was admitted into the hospital he had a temperature of 100°F. and a rapid pulse. He was coughing out a good amount of rusty sputum. Physical examination revealed plenty of moist sounds without any definite impairment of resonance. A radiograph showed scattered, irregular, fairly dense opacities distributed throughout both the lungs. His symptoms disappeared the next day. A radiograph two days later showed complete disappearance of all the opacities. A diagnosis of multiple lobular atelectasis was made.

The interesting point in this case is that even salt water in the smaller bronchioles can produce obstruction and consequent atelectasis, particularly when there is defective respiration.

Fleischner (1940) has reported three cases with benign tumour of the bronchus with obstructive emphysema resulting, in one, and atelectasis with bronchiectasis in the other two. While the ball-valve action of a tumour of the bronchus produced emphysema without bronchial dilatation, complete obstruction by the tumour produced atelectasis and bronchiectasis.

Holinger (1938) and Anspach (1934) have emphasized the importance of broncho-stenosis and consequent atelectasis of the lung tissue in the production of bronchiectasis. Lander and Davidson (1938) demonstrated that bronchial

dilatation occurs as soon as the lung becomes atelectatic. Adams and Escudero (1938) and Weinberg (1937) succeeded in producing atelectasis and bronchiectasis by bronchial obstruction.

That it is not the obstruction of a main bronchus but the atelectasis of the pulmonary parenchyma which is the causative factor in bronchiectasis is evidenced by the occurrence of bronchial dilatation in non-obstructive atelectasis as well. Findlay and Graham (1931) have emphasized the significance of the interesting condition seen in the roentgenograms of dilated bronchi filled with lipiodol. While in a normal lung lipiodol penetrates into the smallest ramifications of the bronchioles, producing the picture of the 'leafy tree', in bronchiectasis the picture is that of a leafless tree, owing to the smaller bronchioles being obstructed.

A study of the history of our knowledge of pathology of bronchiectasis reveals certain very interesting facts. Rokitsanski in 1842 recognizing the occlusion of bronchioles distal to bronchiectasis, emphasized that collapse, contraction, and ultimate obliteration of the surrounding pulmonary parenchyma is the primary lesion and bronchial distension secondary to it. Corrigan in 1838 stated that consolidation and contraction of lung tissue precedes the distension of bronchi. Raymond in 1835 observed the occlusion of bronchial branches distal to bronchiectasis. Though these findings have been confirmed and recorded by many other pathologists in subsequent years, they were not given due consideration, nor were their importance in the elucidation of the pathogenesis of bronchiectasis realized, until very recently.

Thus, an overwhelming mass of evidence has accumulated to indicate the co-existence of bronchiectasis and atelectasis. But no serious attempt has been made to explain the mechanism by which atelectasis produces bronchiectasis. Before enunciating the theory which, in my opinion, is the most probable, it will not be out of place to give a brief summary of the causes of bronchiectasis enumerated in existing textbooks.

Bronchitis, whooping cough, measles, influenza, pleurisy, pneumonia, tuberculosis, inhalation of dust, etc., are some of the causes mentioned. The causative factors are grouped as intrinsic and extrinsic. Bronchitis is supposed to reduce the solidity and resilience of the bronchial wall which yields easily to the intra-bronchial pressure. Fibrosis of the lung and consequent contraction of the surrounding lung parenchyma are mentioned as among the extrinsic agents producing bronchiectasis. Warner (1935) considers that the primary fault is a non-specific infection of the bronchial wall causing destruction, particularly of the muscles and elastic tissues present. The weakened bronchioles then become permanently dilated as a result of the force causing physiological

dilatation of the bronchi. Smith (1930) is of opinion that bronchiectasis is the result of a specific infection with fuso-spirochaetal organisms. Considerable support is lent to the infection theory by the frequent history of previous broncho-pneumonic attacks in these patients and also by the frequent co-existence of bronchiectasis and sinus infections. No doubt infection plays a part in the pathogenesis, but that it by itself cannot produce bronchial dilatation without the simultaneous presence of some other factors is shown by the fact that the great majority of people suffering from acute and chronic respiratory diseases do not develop bronchiectasis. Besides, Adams has shown that destruction of bronchial walls by thermal and chemical irritants is followed by stenosis and not by dilatation.

There are others like Peter Kerley (1934) who consider that all cases of bronchiectasis are congenital in origin. There are certain facts in support of this theory: (1) bronchiectasis has been discovered in some foetal lungs; (2) the existence of bronchial dilatation in children and in adults without any clinical manifestation or previous history of respiratory infection suggests that it might have existed from birth; (3) the writer (1936) found the disease in two brothers without previous history of lung trouble and without definite clinical manifestation of the disease itself. Due to developmental error, bronchial dilatation exists from birth or congenitally weakened walls get subsequently dilated as a result of exaggerated physiological force or some extraneous mechanical stress. It is not possible to say that all cases are congenital in origin. Besides, the theory is not complete in that no attempt is made to explain the mechanism by which actual dilatation is produced.

The writer (1936) in a previous communication has stated that two main factors are required for the production of bronchiectasis, namely, localized weakening of the bronchial walls and a mechanical force to produce dilatation. He does not agree with Fleischner (1940) in considering that the existence of a dilating force alone without previous weakening of the bronchial walls will produce permanent bronchial dilatation. No doubt temporary dilatation of the bronchial walls is produced in certain conditions like active massive collapse of the lung, but weakness of the bronchial wall is necessary for permanent dilatation.

The most important question that is to be answered is the mechanics of the dilating force. Many consider the violent expiratory phase of coughing an important cause of dilatation of the bronchi, but though the intra-bronchial pressure increases greatly during the time the glottis is closed, just before the expiratory blast of air, the force causing it is applied to the external surface of the lungs by the abdominal muscles contracting and pushing the diaphragm

upwards and also by the chest wall. The pressure inside and outside the bronchial wall is therefore the same and there is no dilating effect.

The more plausible view accepted by Hedblom (1931), Wall and Hoyle (1933), Warner (1935) and others is the inspiration theory; in this theory the mechanical force which comes into play during the inspiratory phase of respiration is considered to be the dilating factor. During the height of deep inspiration, the intra-bronchial pressure, i.e., inside the bronchus, is from 10 to 20 mm. of water more than the intra-pleural pressure, which means that atmospheric air exerts that much intra-bronchial pressure. Ingals (1905) and Jackson (1917) have observed through the bronchoscope that the bronchial tubes are dilated during inspiration and that they contract down again during expiration. Ellis (1936) has experimentally recorded the same changes in the calibre of bronchi by means of a special instrument.

No doubt the increased difference between the pressures inside and outside the bronchus during inspiration must naturally form the dilating force, but there must be more factors contributing to a further increase of this difference in pressures which alone can produce bronchial pressure. What is the factor or factors that augment the normally existing inspiratory dilating force? The proper answer to this question will afford the satisfactory explanation for the pathogenesis of bronchial dilatation.

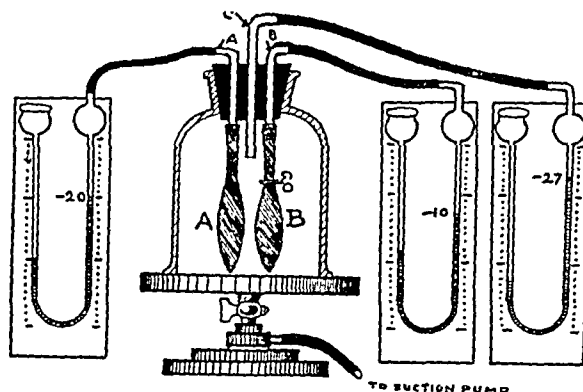
The mechanics of respiration are an interesting study. The forces that come into play are dynamic and not static. There is periodicity, as well as waxing and waning of these forces during the different phases of respiration. Let us consider the variations in pressure inside and outside a bronchus during respiration. During expiration owing to the contractions of the chest the intra-pulmonary pressure is increased and becomes more than the intra-bronchial pressure and air is squeezed into the bronchus through which it escapes outside. During inspiration the chest expands and the intra-pulmonary pressure becomes less than that inside the bronchus; consequently air rushes into the alveolar spaces through the bronchus. The air is as it were aspirated into the lung through the bronchial tube. Hence, when there is free passage for the air into the alveoli there is a relative fall in the intra-bronchial pressure during the inspiratory phase. No doubt the pressure inside the bronchus during inspiration is greater than in the alveoli. Otherwise, there will not be any flow of air from the bronchus into the alveoli. If supposing there is obstruction to one of the bronchioles with consequent prevention of air from getting into the corresponding alveoli, there will not be any movement of air at all just above the obstruction inside the bronchiole, and consequently the fall in the pressure inside that

bronchiole will be much less. In fact, it may even be the same as the atmospheric pressure, whereas the pressure inside the alveoli, supplied by that particular bronchiole which is actually embedded in them, will be practically the same as the pressure in the other parts of the lung, so long as those alveoli contain air. This means that the difference in pressure inside and outside the bronchiole will be greater when the bronchiole is obstructed than when it is not obstructed.

This can be proved to be true by the following simple experiment:—

Two rubber balloons of the same thickness and size are attached to two glass tubings and suspended inside a bell-jar through a rubber cork. The glass tubes are connected to manometers. The bell-jar is placed over the receiving plate of an exhaust pump. Another glass tube is introduced through the cork and connected to a third manometer. (Ordinary Pearson model pneumothorax apparatus manometers were used for this experiment.) A half turn of the wheel of the exhaust pump is made and the excursions of the water column inside the three manometers were simultaneously noted. While the pressures in A and B are found to be equal

#### BELL-JAR EXPERIMENT PRESSURES AFTER TYING B AT THE NECK



the pressure indicated by the manometer connected to C (i.e., the pressure outside the rubber bags and inside the bell-jar) is much less. B is then tied by a string tightly at its neck. When the experiment is repeated now, it is found that the pressure recorded in B is greater than that in A. The following are the readings recorded in one of the experiments:—

	Pressure inside A	Pressure inside B	Pressure inside C (bell-jar)
(1)	— 20	— 20	— 27
(2) With B tied at the neck	— 20	— 10	— 27

During the process of exhausting, the difference in pressure inside and outside the bag acts as the dilating force on the walls of the bag. In the first experiment the dilating force in B is 7 while in the second experiment with B tied at the neck so that no air is allowed to get into the actual bag itself, the dilating force acting on the wall of the tube above the obstruction is 17. The changes in pressure will be practically the same in the case of bronchus and alveoli. In the experiment the narrow tube-like portion of the bag represents the bronchus while the bag-like portion represents the expanding alveolar bed.



There are other factors also which further augment the dilating force by producing more changes in the intra-bronchial and inter-alveolar pressures. When obstruction to a bronchiole is complete, there occurs collapse of the corresponding lobule. Hence the bronchiole instead of being surrounded by spongy cushion-like alveolar tissue gets, as it were, embedded inside stiff, unyielding, atelectic tissue. During inspiratory dilatation of the chest the distension of the lung is mainly taken over by the yielding parenchyma. Only a small pull is transmitted normally to the bronchial wall. If a bronchus is surrounded by atelectic lung and the atelectic tissue fills the space between the bronchus and the chest wall (to assume an extreme case) the pull of the expanding chest is transmitted directly to the bronchial wall as the shock-absorbing action of normal spongy lung tissue is absent.

We have now seen how obstruction to a bronchiole alone might produce bronchial dilatation proximal to obstruction by increasing the difference in the intra- and extra-bronchial pressures. We have also seen how atelectasis of lung tissue resulting from obstruction to the bronchioles augments the dilating force by removing the cushion effect of normal lung tissue. We have yet to see how obstruction can be produced in the smaller bronchioles.

When obstruction to a main bronchus occurs the normal flow of air current is absent. Hence the normal physiological secretions get stagnated in the smaller bronchioles and cause obstruction. According to Fleischner, even under normal conditions when the removal of the physiological secretion is incomplete on account of faulty breathing, secretion may be retained and may temporarily plug the bronchioles. In the second case reported, owing to temporary suspension of respiration due to drowning, the aspirated water was enough to produce lobular atelectasis. Any condition, inflammatory or otherwise, which diminishes respiratory efficiency like acute and chronic infections of the respiratory tract, limited excursion of the diaphragm, pleuritic pain or reflex inhibition of respiration, reduces the cleansing effect of coughing and breathing. The result is accumulation of secretions in the bronchioles and consequent obstruction and atelectasis.

**Conclusion.** By the proper evaluation of the facts of history of pathology of bronchiectasis, experimental and clinical evidences, and the arguments put forward, we can arrive at the following conclusions regarding the pathogenesis of bronchiectasis:—

Augmentation of the inspiratory dilating force alone may produce temporary dilatation of the bronchioles, but for producing permanent bronchial dilatation two factors are required, namely, weakness of bronchial wall, either congenital or acquired, through inflammation,

(Continued at foot of next column)

## TRICHOPHYTON CRATERIFORME IN INDIA

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and

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*TINEA tonsurans* or ringworm of the scalp was first described by Malmsten in 1845. The causative fungus, which was not cultivated at that time, was called *Trichophyton tonsurans*. The endothrix character of the parasite was determined by Sabouraud in 1894 and it was named *Trichophyton megalosporon endothrix* Sabouraud, 1894. On culture the fungus forms crater-like colonies and Bodin called it *Trichophyton crateriforme* (Sabouraud, 1894), Bodin, 1902.

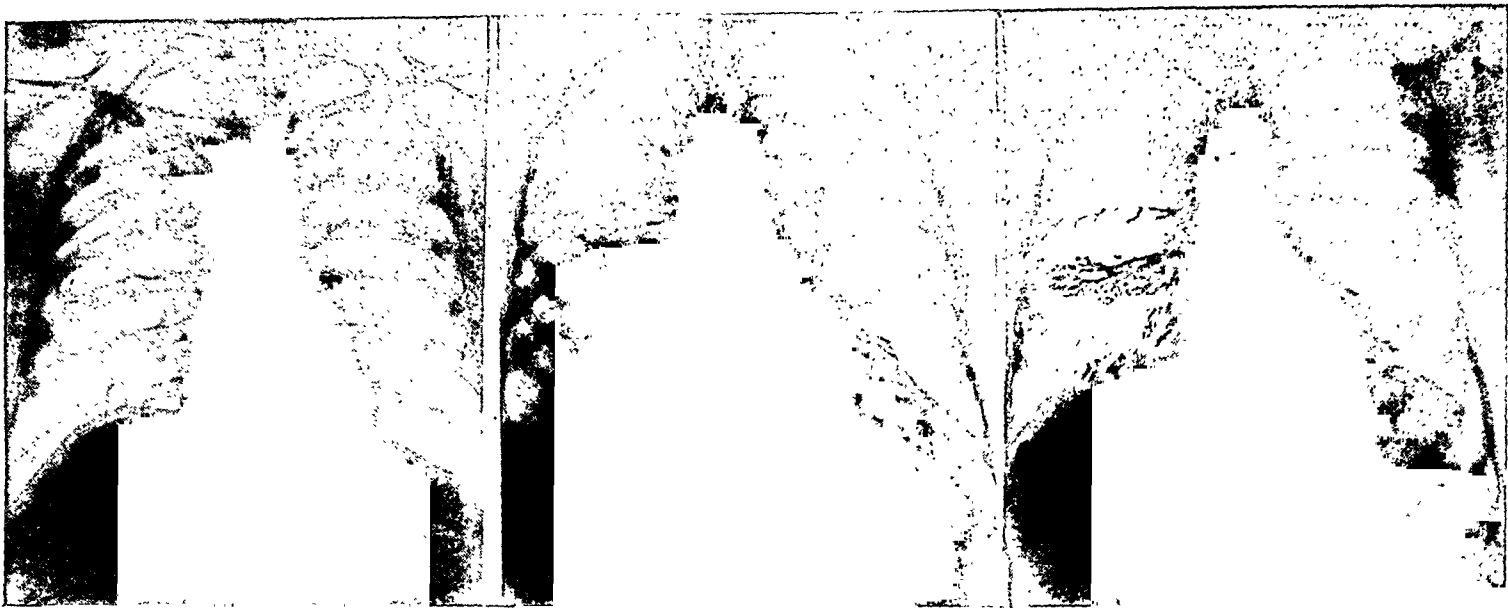
(Continued from previous column)

and the presence of a dilating force. The dilating force is the inspiratory pull on the bronchial walls which is abnormally increased through (1) obstruction to the bronchioles and (2) atelectasis of the lung tissue. Atelectasis is caused by obstruction; and obstruction is caused by collection of secretions in the bronchioles resulting from disturbance of the self-cleansing capacity of the lung by general or local impairment of pulmonary ventilation. Respiratory inefficiency may in its turn be due directly to acute or chronic infections, or indirectly to individual variations in anatomy, and type of breathing, reflex inhibition, or previous infections leaving behind fibrosis or adhesions.

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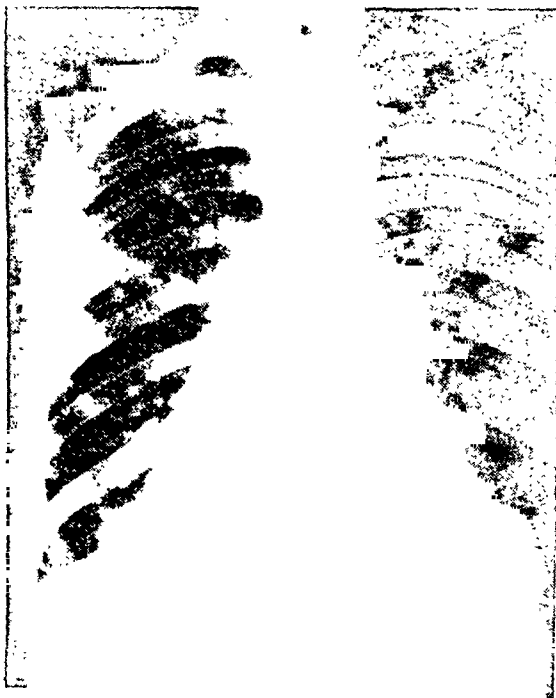
PLATE XXI  
PATHOGENESIS OF BRONCHIECTASIS: R. VISWANATHAN



Case 1.—Tumour hilum. On admission.

Case 1.—Tumour hilum. Two weeks later, showing atelectatic bronchiectasis of right lower lobe.

Case 1.—Tumour hilum. One month later lung expanded. No atelectasis.



Case 2.  
Lobular atelectasis.

Fig. 1.—On admission. Note irregular dense opacities.

Fig. 2.—Third day. Opacities completely cleared.

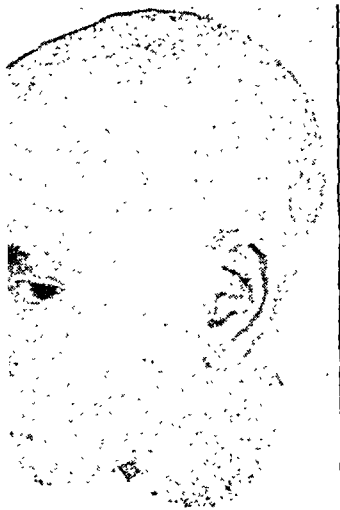


Fig. 1.



Fig. 2.

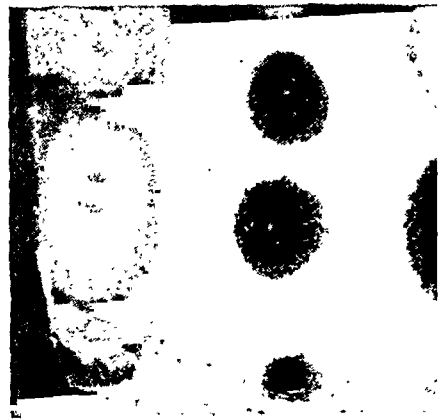


Fig. 3(a).



Fig. 3(b).



Fig. 4(a).



Fig. 4(b).



Fig. 4(c).

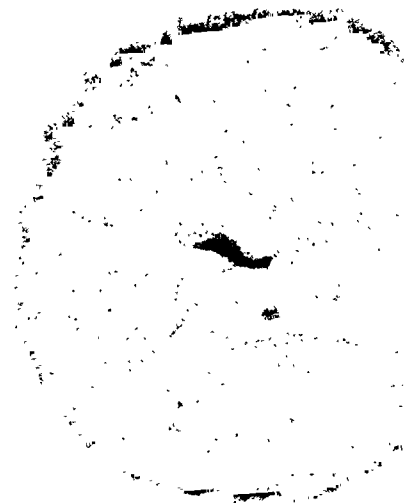


Fig. 3(c).

*Descriptions of illustrations*

Fig. 1.—Multiple patches of 'black dot' ringworm of the scalp caused by *T. crateriforme*.

Fig. 2.—Hair showing mycelia and spores in chains. Mag.  $\times 360$  approx.

Fig. 3.—Cultures on Sabouraud's medium

(a) Primary culture from the hair—three weeks old.

(b) Subcultures in tubes—two weeks old.

(c) Subculture in a flask—four weeks old.

Fig. 4.—Microcultures on Sabouraud's medium

(a) Primary growth from the hair showing clusters of aleurospores. Mag.  $\times 64$  approx.

(b) Simple aleurospores—either sessile or with short stocks.

(c) Aleurospores forming clusters. Mag.  $\times 360$  approx.

The genus *Trichophyton* was subdivided by Sabouraud into endothrix, ectothrix and endo-ectothrix (neo-endothrix) according to whether the fungus attacks the interior, the exterior or both the interior and exterior of the hair.

The characteristic features of an endothrix trichophyton are that it attacks the interior of the hair and grows inside it although in the primary stage, the infection must take place on the outer coating of the hair. This infection is mostly of human origin and spreads from one person to another by direct contact. It is usually confined to the scalp, and children are the worst sufferers. The ectothrix and endo-ectothrix trichophytons, on the other hand, are mostly of animal origin and infection is usually acquired from domestic pets. These fungi attack the secondary sex hairs, commonly the beard area, causing inflammation of the hair follicles.

*Trichophyton crateriforme* causing ringworm of the hair has not been reported from India before. The infection is quite common in Europe where according to Sabouraud it is responsible for 59 per cent (122 out of 207 cases) and Colcott Fox recorded 38 per cent of endothrix infections in England as due to this species.

Out of 169 cases of ringworm of the scalp which have been fully investigated in Calcutta by us, 72 were found to be caused by endothrix trichophyton infection and except the seven cases reported in this paper, the remaining 65 were infected with *Trichophyton violaceum*.

These seven cases of ringworm of the scalp came from a boarding school in Calcutta. The subjects were all Anglo-Indian girls between the ages of 7 and 13 years. In all the patients but one, in whom there was a circular patch on one side of the face, the lesions were confined to the scalp. The lesions of the scalp consisted of multiple small patches of different sizes and shapes. The hairs in these patches were few in number and on careful examination were found broken leaving stumps projecting about 4 to 5 mm. above the surface of the scalp. These stumps were pointing in different directions and were covered with a thick layer of greasy scales. The end of the stumps were sticking out from the scales and gave the appearance of 'black dot' ringworm (figure 1). When the scales were removed, the hairs were found lying coiled up underneath them and when pulled out they were bent like the letters S or Z or twisted spirally.

**Differential diagnosis.**—Clinically, it has been observed that in children, endothrix infections produce multiple bald patches on the scalp. The main characteristic features of *T. crateriforme* infection are the presence of greasy scales heaped up round the hair follicles under which the infected hairs are twisted in various ways and the hairs break a few millimetres above the surface of the scalp, whereas in cases of *T. acuminatum* and *T. violaceum* infection the hairs usually break at the root. In *T. violaceum*

there may be scalliness and hypertrophy of the hair follicles accompanied by inflammatory reaction of the surrounding skin. This fungus also infects hair follicles on other parts of the body—glabrous skin, and nails—more frequently than other endothrix species.

**Microscopic examination.**—Under the microscope the following characteristics were noticed. The fungus affected the interior of the hair. The mycelial filaments measured 4 to 5  $\mu$  in diameter and the old ones divide into spores with square cut ends (figure 2). These spores differ from those of other endothrix trichophytons, namely *T. acuminatum* and *T. violaceum*, which are usually oval in shape.

**Cultural appearance.**—For the primary culture Sabouraud's proof medium was used but Merck's maltose was substituted for crude maltose.

In the primary culture the growth appeared on the 4th or 5th day at room temperature. In early cultures the surface of the growth was white and velvety with a knob-like prominence in the centre giving the appearance of a powder puff, as described by Sabouraud. Later on a depression often appeared at the centre of the knob, resembling a crater (figures 3a, b and c). The surface, which at first was white and velvety, later became brownish or yellowish-brown and powdery. The growth was somewhat hard, cartilaginous in texture and did not easily break. Subcultures in different laboratory media had the same characters as the primary growth.

Pleomorphism was not observed in any case.

**Morphology.**—Sabouraud's proof medium was used throughout the experiment. Morphology was studied from hanging drop preparations in wetted slides made from infected hairs (figure 4a) and from subcultures, aleurospores were the only end-organs noticed, they varied from 5 to 7  $\mu$  in length and 2.2 to 2.8  $\mu$  in breadth. These were either simple, sessile or with short stalks, situated at the side or at the terminal part of a growing hypha, or they were compound, forming clusters or thyruses as they are called (figures 4b and c). Intercalary chlamydospores were also found. In some instances the terminal parts of the hyphae were club-shaped.

Culture of *T. crateriforme* has a powdery surface and a central crater. This crater formation is so characteristic that the species has been named after it. *T. acuminatum* has a powdery growth but its centre is raised and acuminate. The growth of *T. violaceum* is very different from the above two species; because it is raised, faviform and coloured different shades of violet. *Trichophyton sulfureum* also produces endothrix lesion of the hair and resembles *T. crateriforme* in almost every respect except that on culture the growth takes up a delicate yellow colour.

#### Biochemical reactions

- (a) Sugar—no fermentation on ordinary laboratory sugars.
- (b) Proteolysis—no proteolysis in Löffler's medium.
- (c) Milk—the milk protein (casein) was proteolyzed giving a translucent appearance to the milk.
- (d) Haemolysis—no haemolysis in blood sugar.

#### Animal inoculations

The abdominal skin of guinea-pigs, rabbits and mice were inoculated with an emulsion of the culture after scarifying the part. Typical lesions were produced at the site of the inoculation and fungus was isolated from them. The animals recovered spontaneously in about a month.

#### Summary

1. The occurrence of *Trichophyton crateriforme* infection is reported for the first time in India.
2. The morphology and cultural characters of the fungus have been described.

## A NOTE ON COMPLEMENT FIXATION IN HYDATID DISEASE AND ASSOCIATED CONSIDERATIONS

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THE intention is to (i) draw clinicians' attention to a newly described serological technique for the laboratory diagnosis of hydatid disease, (ii) give the positive findings obtained with sera received from widely separated localities in India, during the last 11 months, (iii) make observations on the utility of the reaction in the diagnosis and in estimating the progress of cases not treated surgically, and (iv) comment on the infestation in India.

### A NEWLY DEVELOPED TECHNIQUE

The technique has been described in detail by the writers elsewhere (Greval, Chandra and Das, 1941). Its essential features are three:

(i) The antigen is selected, pooled, phenolized and preserved in a refrigerator: it keeps for at least one year and provides a constant product which gives repeatable and, therefore, comparable reactions.

(ii) The dose of the antigen is linked to the hæmolytic system: it is not anticomplementary when used with 1 M. H. D. of complement and is not hæmolytic even when multiplied by three.

(iii) The reaction is linked to the Wassermann reaction and is put up only when a complement of optimal reaction and titre for the latter reaction is available (Greval, Chandra and Das, 1940). A Wassermann reaction is done on the serum at the same time.

The antigen is the hydatid fluid from freshly slaughtered sheep as recommended by previous workers (Fairley, quoted by Dew, 1928; McIntosh, 1931).

The serum is tested in dilutions of 1 in 10, 1 in 50, 1 in 100 and 1 in 200 routinely, and in other dilutions afterwards, if so indicated. The complement is used in a constant dose of 2 M. H. D.

The sensitiveness and specificity of the reaction are of a high order. Only a reaction

giving full inhibition of lysis (no trace of lysis) is read positive.

The sera are collected and despatched as for the Wassermann reaction. Incidentally, the standardized preserved antigen is also available for intradermal tests.

### POSITIVE FINDINGS DURING THE LAST 11 MONTHS FROM 20TH JUNE, 1940

One serum was found positive in Calcutta (titre 1 in 100, just; diagnosis confirmed surgically and microscopically; Indian patient). Later, at the senior writer's request to surgeons-general, inspectors general of civil hospitals and directors of research institutes, in India and Burma, four positive sera were obtained from Madras (titre 1 in 10; diagnosis doubtful; Indian patient), Salem (in Madras Presidency; titre 1 in 50; diagnosis confirmed surgically and microscopically; Indian patient), Coonoor (titre 1 in 40; not diagnosed surgically; medical diagnosis of fits due to cysts; Indian patient), and Dera Ghazi Khan (in the Punjab; titre 1 in 25; diagnosis confirmed surgically and microscopically; Indian patient), respectively.

During the same period, out of five other sera received for the test, two were doubtful and three negative.

During this period a surgically and microscopically positive Indian case has been reported from Lahore (Khanna, 1941). Serological reaction was not done.

The only previous serologically positive case at Calcutta appears to have been one published in connection with a suspected case of tuberculosis (Ukil and Ganguli, 1937). Details of procedure are not given.

### UTILITY OF THE REACTION

The utility of the reaction in diagnosis is obvious in view of its sensitiveness, specificity and comparableness. Will the reaction indicate retrogression of the disease as a result of treatments other than surgery? Such treatments are x-ray (Tyzzer, 1933) and medicinal treatment of systems other than European allopathy and of homeopathy, which are always on trial in India.

The hydatid cyst in the sheep is *Cysticircus granulosus*. The usual hydatid cyst in man is the same. For the detection of the unusual *Cysticircus cellulosæ* in man the fluid from the corresponding hydatid cysts in the pig would be a better reagent. These cysts, however, are not so readily procurable. It is not known to the writers how far a group reaction with the fluid from the hydatid cysts in the sheep succeeds in detecting the unusual *Cysticircus cellulosæ* cysts in man: such a reaction has been obtained in some proved cases but not in others (Dixon and Smithers, 1935). The reaction of sera from patients that are hosts of tapeworms is also unknown.

INFESTATION WITH *Cysticircus* IN INDIA

Infestation in sheep in Calcutta is common. A dozen fluids can be obtained sometimes on one day from the municipal slaughter house. Infestation in man is apparently rare. This is held to be true of the whole of India and also of Egypt and China (Dew, *loc. cit.*). But the infestation though reported infrequently is widespread in India. Probably the disease is often missed. Such is the opinion of previous workers also (Mahadevan and Menon, 1933; Sami, 1938). The cases now reported were contacted soon after circularization. The interest which appears to have waned already may wax again as a result of this note and bring to light more cases.

Infestation in one series of dogs with the adult worm was found to be only 2 per cent in 100 dogs examined in Calcutta (Maplestone, 1933). It was, however, held 'very probable that *granulosus* infection is fairly common in dogs in the country districts in India'. In another and recent series the infestation has been found to be 18 per cent (Maplestone and Bhaduri, 1940).

Does nature terminate the infestation in most cases in man in India? The reported absence of eosinophilia in old cases of hydatid (Mahadevan and Menon, *loc. cit.*) may point to a loss of activity or even vitality of the *cysticircus*.

The total number of cases reported in India since 1933 by the writers quoted in the note, including the number under report, is forty-six.

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## TAKING BLOOD FOR TRANSFUSION : FURTHER IMPROVISATIONS

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In two previous communications (Grevall and Chandra, 1940; Grevall, Chandra and Roy Chowdhury, 1940) use of Potain's aspirator, with or without the pump, has been advocated for taking blood for transfusion in a closed system. The procedure is so controlled that air-borne contamination either does not enter or enters in a quantity which is effectively overcome by the fresh living blood. In 102 bottles of blood collected consecutively for storage between 22nd November, 1939, and 22nd April, 1941, (date of starting storage and date of writing this note, respectively) not a single bottle was found contaminated on inspection (by sight and smell). Between the same dates no accidents resulted from 75 consecutive transfusions given with stored blood.

The special stopper of the aspirator has lately become difficult to obtain or repair. The writers have in its place employed two separate metal tubes, bent at right angles with a gentle curve to provide a horizontal and a vertical limb. The ends of the horizontal limbs fit adapters of the rubber tubes of Potain's aspirator. The vertical limbs pass through a rubber stopper which fits a bottle. One of these tubes, receiving a male adapter, acts as an inlet and the other, going into a female adapter, acts as an outlet. The inlet ends at a lower level than the outlet. Instead of the taps of Potain's aspirator, two Hoffmann's clips (burette clips for pressure tubing, operated by turning screws) are placed on the rubber tubes.

When the rubber stopper and the metal tubes are sterilized both the horizontal limbs point in the same direction to economize space. The rubber tubes are sterilized with the clips in position. The clips can be attached later when they are hinged.

The clips make two precautions necessary : (i) the load on the rubber tubes must be supported or else the adapters are likely to get dislocated, and (ii) how many turns of the screw will open or close the tubes must be determined beforehand.

The outlet can be fitted with a two-way tap and the bottle exhausted with a record syringe if the pump of Potain's aspirator is not available. Even without a two-way tap the bottle can be exhausted sufficiently by removing

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# BACT. ALKALESCENS IN INFECTION OF THE URINARY TRACT AND BACTERIOPHAGE THERAPY

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ANDREWES (1918) in a paper on the differentiation of true dysentery bacilli from allied organisms described and named three species or groups of species of bacilli which though strongly resembling the true dysentery bacilli were not considered by him as causal agents of dysentery; one of these was *Bacterium alkalescens*.

Andrewes described it as a Gram-negative non-motile bacillus which produced acid but no gas in glucose, maltose, mannitol and dulcitol. Lactose and saccharose are not fermented. Indole was formed by all strains examined by him and litmus milk became markedly alkaline after a week or ten days. The organism was not agglutinated by specific Shiga or Flexner-Y serum within the ordinary time limits of 4 to 5 hours at 55°C., but when the tubes were left at this temperature for 20 to 24 hours agglutination with Flexner serum occurred with some

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syringe-fuls of air and closing the tube while removing and re-applying the syringe by means of an adapter. The water aspirator pump, fixed to a water tap, may be used. Suction by mouth at the distal end of the outlet produces enough exhaustion of the bottle. Care is necessary in making a second attempt when saliva may be drawn into the bottle.

The General Scientific Engineering Co., 4/1, Harish Mukherji Road, Calcutta, supply two metal tubes and four adapters, complete set for a bottle, for Rs. 10. The metal is silver-plated brass.

Even glass tubes can be used in the place of the metal tubes. They are, however, inconvenient to fit into rubber tubes and of course are liable to break.

Incidentally, the writers now use routinely a 3 per cent solution of sodium citrate instead of 2.5 per cent. As before, one-tenth volume of the ultimate content of the bottle is taken (e.g., 40 c.cm. for 400 c.cm.). The concentration in the citrated blood is 0.3 per cent instead of 0.25 per cent.

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ROY CHOWDHURY, A. B.  
(1940).

strains but always well below the titre of the serum. In no case was it agglutinated by the serum of the patient from whom it was isolated. Andrewes concluded that *Bact. alkalescens* 'can be rejected as having no connexion with dysentery'.

Many of the subsequent authors regard *Bact. alkalescens* as non-pathogenic. Park and Williams (1934) write of it as 'apparently non-pathogenic and of importance only because of the possibility of confusing it with the pathogenic varieties'. Gay (1935) states that it is 'distinctly non-pathogenic', and Havens (1935) as an organism 'whose pathogenicity has not yet been established'. Topley and Wilson (1936) write 'whether this organism is capable of giving rise to real dysentery is doubtful. Since, however, it has been isolated from the blood stream of a woman with puerperal fever (Smith and Fraser, 1928) and has been found in an institutional outbreak of food-poisoning (Welch and Mickle, 1934) its occasional pathogenicity for man must probably be accepted'. Bergey (1939) in the latest edition of the *Manual of Determinative Bacteriology* describes it as 'not pathogenic'.

Smith and Fraser (1928) were the first to assign a definite pathogenic rôle to *Bact. alkalescens*. They described a case of continued fever due to this organism. Since then there has been an increasing number of reported instances where *Bact. alkalescens* has caused disease in man. This evidence has been collected, reviewed and well summarized by Nabarro and Edward (1939) who also record a series of seventeen of their own cases where *Bact. alkalescens* was isolated from the faeces. In these it was associated with disease nearly always involving the intestinal tract. These authors conclude that infection with *Bact. alkalescens* is primarily intestinal giving rise to a mild form of acute dysentery or chronic colitis and that lesions produced elsewhere are to be regarded as complications. These workers give thirteen references in which *Bact. alkalescens* is reported to have caused pyelitis or other infection of the urinary tract. In these cases *Bact. alkalescens* was recovered in pure culture from the urine and in several, agglutinins in significant titre were demonstrated in the serum. In India, Boyd (1932) found *Bact. alkalescens* five times, three times in Poona and twice in Bangalore. Of its pathogenicity he states 'all five strains were recovered from the stools of normal individuals. There is, therefore, no suggestion of pathogenicity, a finding which accords with the opinion formed by Andrewes'.

From this brief survey of the literature it is obvious that there is no unanimity of opinion regarding the pathogenicity of *Bact. alkalescens*. It is for this reason that a brief account is given of a patient from whom this organism was isolated in pure culture several times from the urine and in whom there was sufficient evidence to regard it as the causative agent. There were

in addition certain interesting features following bacteriophage therapy; and reference to these is included.

The patient, a Scot, aged 52 years, who had seen some 25 years of service in India had been suffering from symptoms typical of cystitis for about a month. There was no history of intestinal disturbance or of any previous urinary trouble. Except for a slight but definite enlargement of the prostate (probably physiological), nothing abnormal was found on physical examination. The urine was turbid and contained a large number of pus cells and on culture *Bact. alkalescens* was isolated in pure culture. During the first month of observation 51 samples of urine were examined and the organism was isolated from 45 of the samples. It was also isolated from each of the three samples of stools examined.

All strains gave identical biochemical reactions. They produced acid but no gas in glucose, maltose, mannitol and dulcitol. There was no change in lactose, saccharose and salicin. Indole was produced and litmus milk turned alkaline. Representative strains were tested with the patient's serum (blood drawn about five weeks after the onset of symptoms) and were agglutinated up to 1 in 500 dilution. This organism agglutinated with a polyvalent Flexner serum but only to 1/10th of the titre of the serum. A serum was raised against the strain isolated from the first specimen of urine and this serum agglutinated to titre (1 in 10,000) the strains isolated later.

An active and potent alkalescens phage was prepared. It caused complete clearing of a young broth culture in about one hour and the lysis was maintained for about 72 hours when a faint turbidity appeared. This bacteriophage was given to the patient in doses of 2 c.cm. in 2 ounces of water three times a day for a month. Bacteriophage active against *Bact. alkalescens* was not present in samples of stool and urine examined before the administration of alkalescens phage, but was recovered from the stool a day after and from urine two days after the administration of the phage by mouth. *Bact. alkalescens* was not found in any of the eight samples of stools examined during and after phage treatment.

The effect of bacteriophage therapy on the organisms in the urine was interesting. The first effect was to render the urine less turbid and fewer organisms were recovered and these were obviously phage-infected. The colonies on the plate were variously notched and some showed minute areas of phage clearings. This was followed by some days when the urine contained potent alkalescens phage and gave no growth of any organisms or when, in spite of the presence of active phage, a few isolated colonies were obtained. After about a week however of such findings the urine became markedly turbid and gave a heavy growth of *Bact. alkalescens*.

Bacteriophage was present in the urine intermittently; it would be found regularly for two days (two samples examined each day), be absent for two or three days, and then be found again. An attempt was made to correlate this with the reaction of the urine, but no such correlation could be made.

A study was made of the strains of *Bact. alkalescens* isolated from the urine before and after the administration of alkalescens phage and their lysability by (1) the phage administered, (2) the phage recovered from the stool and (3) the urine, and (4) the phage contaminating the organism isolated after phage therapy. The strains (urine and stool) isolated before the administration of alkalescens phage were lysable by (1), (2), (3) and (4). The strains of *Bact. alkalescens* recovered from the urine after the administration of phage orally and when the phage had appeared in the urine were lysed by (1) and (2), the original phage, and by the phage recovered from the stool. These strains were resistant to the phage races (3) and (4), those found in the urine and those contaminating the organisms. These results show that the phage given to the patient contained more than one type and that only one type of alkalescens phage was able to get through to the urine or survive in the urine.

The alkalescens phage was given daily for a month without producing any effect either on the clinical symptoms or on the condition of the urine, which continued to contain pus cells and the organisms in large numbers. An autogenous vaccine was prepared with the strain originally isolated. The response to vaccine therapy was striking and the urine was clear and free from organisms 17 days after the commencement of vaccine therapy. The clinical condition improved considerably and the patient was completely cured.

#### Summary

1. Attention is drawn to the evidence implicating *Bact. alkalescens* as a pathogen of man.

2. A case is recorded in which *Bact. alkalescens* caused cystitis. This organism was isolated in pure culture from the urine on several occasions during the course of the disease and disappeared when the symptoms subsided. It was isolated also from samples of stool. Agglutinins for *Bact. alkalescens* were present in the patient's serum.

3. Alkalescens phage was given by mouth for a month. This led to the rapid disappearance of the organism from the stools, but had only a transient effect on the ordinary infection. Only one type of alkalescens phage was found in the urine, whereas the bacteriophage given by mouth contained two distinct types.

4. Bacteriophage therapy having failed to control the infection, autogenous vaccine was used with satisfactory results.

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## BACTERIOPHAGES IN SOIL

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DURING the course of certain experiments designed to demonstrate 'antagonistic bacteria' for intestinal pathogenic bacteria of man, the interesting observation was made, that many samples of garden and field soil contain bacteriophages active against these organisms.

A 1 in 100 suspension in saline of soil when added in 1 c.cm. amounts to melted agar containing a thick suspension of one of the test bacteria and poured, after incubation, showed a number of bacteriophage colonies. *Bacterium typhosum*, *Bact. flexneri*, *Bact. shigæ* and *Vibrio cholerae* were used as the test organisms, and from twelve of the sixteen samples of soils examined bacteriophages active against some or all the four test organisms were isolated. In some plates as many as 120 bacteriophage colonies were present. The most frequently occurring bacteriophages were the dysentery-phages and next in order typhoidphages and cholera-phages. These bacteriophages were present in samples of soil taken at different levels (down to 3 feet) below the surface.

These findings demonstrate how widely bacteriophages are distributed in nature.

(Continued from previous page)

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## NOTES ON COMMON SKIN DISEASES

## III. RINGWORM OF THE SCALP : FAVUS

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FAVUS is so distinct from other ringworms that we decided to treat it separately. It is a highly contagious disease and affects adults and children alike; it spreads by extension from the scalp to the body. In India, the disease is endemic in Kashmir, the Punjab, the North-West Frontier Province, and Rajputana, but does not usually occur in the eastern and southern parts of India. It is commonly found amongst the poor and is not a problem of the boarding schools.

The causative organism is a fungus of the genus *Achorion* and, of the various species, both *Achorion schönleini* and *A. actoni* have been reported from India.

Clinically, the disease has certain distinctive features. It begins as small yellow sulphur-coloured cup-shaped discs around the hair follicles. The concavity of the cup is upwards and the convexity is towards the surface of the scalp. When a disc is removed, it leaves an oozing ulcerated area on the scalp; the base of the ulcer is red and oozes a sero-purulent discharge. The yellow discs, or 'scutula' as they are called, gradually increase in size and coalesce with the adjacent ones. In an advanced case, the whole scalp appears to be covered with a thick yellow-coloured mud plaster. The lesions spread from the scalp to the body and form the same type of scutula among the lanugo hairs. A fully-developed case of favus presents no difficulty in the diagnosis and the patients emit a peculiar smell from the lesions like that of mouse urine.

If one of the discs or scutula is removed with a pair of forceps, some amount of force is required to pull it off and the hairs at the centre of the scutula come out with them from the root.

When a scutulum is dissolved with 40 per cent liquor potassii and examined under the microscope, it is found to consist of a network of mycelial threads in which are embedded epithelial debris and pus cells. In the hairs, the mycelia are arranged along the long axis and hence the hairs split longitudinally and do not break.

*Prophylaxis*.—The disease is highly contagious and complete segregation of the patient is necessary. Hats, turbans or any other head dress must be burnt and tight-fitting cotton caps given to wear until the patients are completely cured.

*Treatment*.—Epilation of the infected hair manually, or by x-rays, and then treatment of the scalp with mild antiseptics are essential features of the treatment. In favus, unless

fairly advanced, epilation is easy as the hairs, not being brittle, come out with scutula when these are removed.

A good method of removing the scutulum is to soak the scalp overnight with the following:—

R Phenol ..	..	15 minims
Mercuric oleate ..	..	10 grains
Olive oil ..	..	$\frac{1}{2}$ ounce
Vaseline ..	..	$\frac{1}{2}$ ounce

In the morning, wash the scalp with spirit soap shampoo (soft soap 1 oz., spiritus rectificatus 2 oz.) and water. During the washing, remove the scutula with the hair, as much as possible. After the shampoo wipe the part dry, apply

dilute ammoniated mercury ointment, 1 per cent to 2 per cent, to the ulcerated parts and repeat this process for 3 or 4 successive days until the scalp is fairly clear. In the case of an acute inflammatory condition, warm compress with 1/200 phenol, changed every 3 hours, will be of great benefit. When the inflammatory condition subsides, the scalp is fairly clean, and the ulcers have healed, in mild cases without any inflammation, Whitfield's ointment or thymol iodine paint may be applied.

In refractory cases, there need not be any hesitation in advising the patient x-ray treatment by an expert radiologist. The chances of baldness resulting from the disease are much greater than from faulty x-ray treatment.

## A Mirror of Hospital Practice

### A CASE OF CAVERNOUS SINUS THROMBOSIS COMPLICATING MENINGOCOCCAL MENINGITIS WITH RECOVERY

By C. J. HASSETT

CAPTAIN, I.M.S.

Agency Surgeon, North Waziristan

RASHA DIN, aged 19 years, was admitted into hospital on 13th October, 1940, with a history of headache for the past three days. Twelve hours prior to admission he had noticed that his left eye began to bulge and that the lids became swollen and oedematous with constant lachrymation; up to this he had been in excellent health, the temperature was 100°F. and the pulse rate 84 per minute.

*Physical examination.*—He was conscious but somewhat apathetic. There was exophthalmos of the left eye (see figure), the upper and lower lids were swollen and oedematous; the conjunctiva was chemosed; movements of the eye-ball were absent and the pupil failed to react to light. There was absence of vision;



Photograph taken on second day of admission.

ophthalmoscopic examination revealed choked disc and retinal hæmorrhages. The right eye was normal; the throat, teeth and sinuses were normal; there were no signs of sepsis on the face; the other cranial nerves

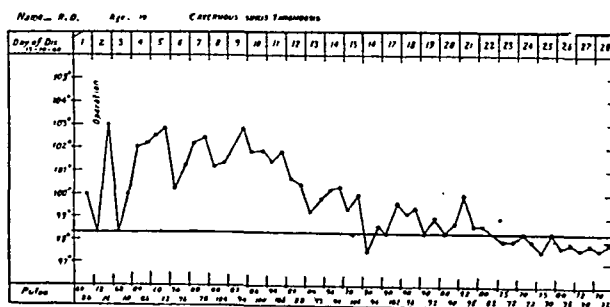
were normal; the knee and ankle jerks were exaggerated; the plantar reflexes were normal; there was no clonus; the abdominal reflexes were brisk; Kernig's sign was negative; there was no rigidity of the neck muscles; there was no impairment of sensation. The spine and cranium showed no abnormality. The visceral reflexes were normal. There was no rash. Examination of other systems was negative.

*Laboratory findings.*—13th October. Blood: malarial parasites—negative, red cells 4,550,000 per c.cm., leucocytes 25,312 per c.cm. Differential count—polymorphonuclears 85 per cent, lymphocytes 12 per cent, large mononuclears 3 per cent. Culture—sterile.

Cerebrospinal fluid: 1,109 cells per c.cm., meningococci positive. Nonne-Apelt test positive. Urine and stools normal.

14th October. The right eye now showed exophthalmos though not so severe as in the left eye. There was some chemosis of the conjunctiva, movements were restricted, vision was normal. Ophthalmoscopic examination revealed no abnormality. General examination revealed a positive Kernig's sign and rigidity of the neck muscles.

*Treatment.*—Lumbar puncture was performed on the day of admission when 30 c.cm. of purulent fluid were removed. He was put on sulphapyridine, 2 grammes four hourly by mouth, and 2.5 grammes by intramuscular injection. In all a total of 67 grammes was given. As



remarked the right eye showed involvement. The left eye was more proptosed and swollen and showed signs of irido-cyclitis. The discharge was now purulent; normal saline washes were given to the right eye and liquid paraffin drops were instilled. Owing to the onset of suppuration in the left eye and with a view to preserving the vision in the right eye, it was decided to enucleate it. This was done under ether anaesthesia on the second day after admission. After the removal of the eye, the patient stated that he felt more comfortable and there was no further protrusion of the right

eye-ball. Recession began to take place though slowly. It was complete in two months; at present there is slight hypertrophy of the lower tarsal conjunctiva; movements and vision are now normal. A daily check was also kept on the white cell count to avoid the possible toxic effects of the sulphapyridine. Lumbar puncture was carried out daily for six days, when it was discontinued as there was no further indications for its employment.

During his illness he developed a mild parotitis on the left side which cleared up with an intravenous injection of calcium gluconate, and he was given chewing gum to promote the flow of saliva. The temperature chart of the case is given.

**Discussion.**—Such a complication of meningococcal meningitis appears to be very rare. It is not an uncommon complication of septic processes on the face, suppuration in the sphenoidal air cells, inflammation of the jaw or teeth sockets. In the well-known textbooks of medicine such a complication of meningococcal meningitis is not mentioned nor have I been able to trace such a complication in the literature at my disposal. When the case was first seen, discussion arose as to whether the thrombosis was the primary cause of the meningitis following on a possible source of sepsis in the orbit, or whether the meningitis was primary and the thrombosis of the cavernous sinus secondary. This was settled by the lumbar puncture and the demonstration of meningococci in the fluid.

## A MOBILE APPENDICAL ABSCESS

By R. D. MACRAE, F.R.C.S.E.

CAPTAIN, I.M.S.

*Agency Surgeon, Gilgit, via Kashmir*

A YOUNG Mohammedan male was admitted with a history of recurring mild attacks of pain in the right iliac fossa. There had been nausea but no vomiting. After an unusually distinct attack of the pain had come and gone, he sought advice, and an explanation of his symptoms. He walked to the out-patient department.

Examination revealed a furred tongue, a slightly increased leucocyte count, and a tender mass in the right iliac fossa about the size of an egg. The mass was so mobile that it could be depressed towards the pelvic brim, when it could no longer be felt. It moved vertically more easily than laterally. There was no rigidity, no cutaneous hyperaesthesia, no tenderness elsewhere in the abdomen or per rectum, and the psoas test was negative. The temperature was 99°F.

Diagnosis was indefinite, and cystic tumour, or abscess of the appendix, torsion of the omentum, and torsion or partial strangulation of a Meckel's diverticulum were suggested.

The abdomen was opened under spinal anaesthesia by a paramedian incision. The proximal inch of the appendix appeared normal; the rest was hidden in a round, cystic mass of tissue composed of the lower edge of the great omentum. There were only string-like adhesions to the ileum. The mass was delivered into the wound, the adhesions separated, the omentum clamped, divided, and ligated, and then appendectomy completed in the usual way.

The specimen was incised and showed a perforated appendix, surrounded by omentum, which everywhere formed the wall of an abscess containing homogeneous, odourless pus. Recovery was uneventful.

It is surmised that an appendical mucocoele became infected by organisms of low virulence, and complete omental adhesion formed before perforation occurred.

## A CASE OF CEREBRAL MALARIA WITH RARE COMPLICATIONS AND COMPLETE RECOVERY

By R. M. LLOYD STILL

MAJOR, I.M.S.

*Medical Officer, Burma Frontier Force Hospital, Myitkyina*

and

RAI SAHIB T. N. LAL, L.M.P.

*Burma Frontier Force Hospital, Myitkyina*

ON 12th November, 1940, at 7-30 a.m., a Punjabi Mohammedan woman, aged 18 years, was admitted into Family Line Hospital, Burma Frontier Force, Myitkyina, with fever and in a semi-conscious condition.

**History.**—The patient was reported to have had fever with rigor at 3 p.m. on the previous day.

Temperature on admission 102°F. Pulse—rapid but regular and strong. Respiration—28 per minute.

**Examination.**—Though the temperature was not very high, patient was rapidly becoming unconscious.

Lungs—clear. Heart—nothing abnormal detected. Liver—not enlarged. Spleen—not enlarged. Urine—catheter specimen revealed nothing abnormal.

**Nervous system.**—Knee jerks—present but sluggish. Kernig's and Babinski's signs absent. There was no rigidity of the neck. Pupils were equal and reacted both to light and accommodation.

Examination of blood for malaria parasites showed malignant tertian rings and marked mononucleosis.

Patient was given an intravenous injection of quinine gr. x and placed on usual treatment for malaria. At 8 p.m. the same day temperature went up to 104°F. and she became deeply comatose. Pulse was very rapid and weak. She was given four-hourly injections of gr. 1/100 digitalin. Intramuscular injection gr. x of quinine was also given at night.

13th. Temperature fell to 102.2°F. Pulse—110 per minute, weak but regular.

Lumbar puncture was done and cerebrospinal fluid was clear and not under pressure. Blood for Kahn test was negative.

In the evening the patient regained consciousness partially, and began to take notice of her surroundings but was unable to speak. Quinine was given orally and also another intramuscular injection.

14th. In the morning the temperature was 100.8°F. Patient was fully conscious but aphasia was still present. Patient showed by signs that she had headache and also expressed her wishes by signs. She was not incontinent. Another injection of quinine was given and also quinine mixture orally.

15th. Temperature dropped to 99.4°F. Patient was fully conscious, but aphasia was still present. Pulse was regular and of good tension and general condition much improved. On 17th, however, she developed hemiplegia of the right side of the body. Temperature was normal and aphasia was still present. From 17th onwards temperature remained normal. Treatment for hemiplegia with massage, iodides, etc., and also for malaria was carried out and the patient regained the use of her leg on 1st December. On 5th December, she could speak a few syllables though the speech was slurred. She regained the use of her arm on the 10th. From then onwards she improved steadily and was discharged as cured on 22nd December, 1940.

**Notes.**—(1) This case is reported as it had some unusual and interesting features. Although hemiplegia and aphasia are reported as rare complications of cerebral malaria the two together are very unusual, especially as the aphasia occurred 3 days before the hemiplegia.

(2) There was not a heavy infection of malignant tertian or other forms of malaria parasite as one would expect in such a case and the temperature was not unusually high on admission.

(3) Complete recovery in a relatively short space of time.

## A CASE OF PYÆMIA TREATED WITH SULPHATHIAZOLE

By J. W. D. GOODALL, M.D., M.R.C.P. (Edin.)  
MAJOR, I.M.S.

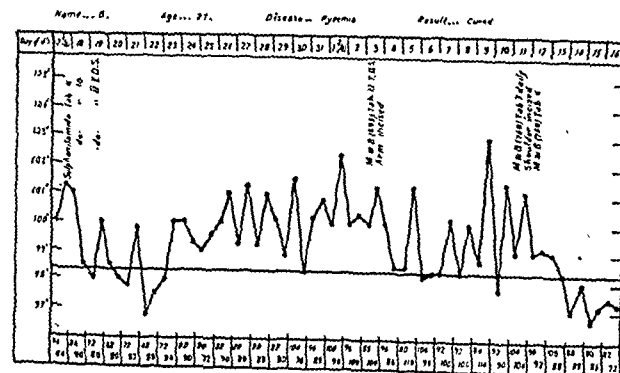
UNTIL recently sulphathiazole (M. & B. 760) has not been readily obtainable in the Indian market. In Great Britain and the U. S. A. it has been employed against streptococcal and staphylococcal infections with some success.

Paterson and Walker (1940) cured a case of osteomyelitis and pericarditis with this drug. The experimental work of Wagle, Sokhey, Dikshit, and Ganapathy (1941) in the use of sulphathiazole against plague, and of Rao and Ganapathi (1941) in its use against *B. typhosus* show that it has some effect against these organisms. These latter workers, as a result of experiments on mice (1940), believe that sulphathiazole 'is distinctly superior to sulphanilamide and sulphapyridine in streptococcal infection and is as good as sulphapyridine in pneumococcal infection'.

The following case which was diagnosed as pyæmia probably of staphylococcal origin and treated by sulphathiazole (M. & B. 760) may be of interest.

Captain B., aged 27 years, was admitted into hospital on 17th January, 1941, complaining of pain and swelling of his nose. He stated that three days previously he had picked a black-head on his nose and squeezed it. It became very painful so he called in the doctor next day who gave him tablets of sulphanilamide to take (2 *t.d.s.*). The following day he was given eight tablets but as he was slightly worse and the swelling and redness of his nose had increased he was admitted into hospital.

*Previous illnesses.*—He stated that in May of last year he developed blood-poisoning from septic heels after a route march. Also he had suffered from an undiagnosed fever when on leave in England in 1939.



*Examination.*—The patient was found to have a temperature of 101°F. and a raised pulse rate. The nose was red and inflamed and the area of inflammation extended on to the left cheek. The skin was unbroken. On general examination nothing of significance was noticed, except that he had a pigeon chest.

*Investigations.*—The white blood count was 8,200 per c.mm. and the red blood count 4½ millions per c.mm. The Wassermann was negative. Urine and stools normal.

*Treatment.*—The sulphanilamide tablets were continued in hospital for three days in a dosage of 10, 6, and 4 daily.

*Progress.*—The sulphanilamide did not have any appreciable effect on the course of the disease and was stopped on the fourth day in hospital. His condition became worse, but by fomenting his nose some thick discharge came away at the end of a week.

On the eighteenth day of hospital treatment a swelling of his right upper arm which had given him pain for four days was opened under local anaesthesia and thick chocolate-coloured pus was drained out. The arm was fomented, his bowels were regulated with liquid paraffin and he was given Ostomalt. In addition he was treated with sulphapyridine (M. & B. 693) for the next seven days, giving two tablets three times a day. This also had no appreciable effect on the course of the disease.

After 26 days in hospital he was given sulphathiazole (M. & B. 760) starting with four tablets the first day and 2 *t.d.s.* for the next five days. Another painful swelling had meanwhile appeared over the right shoulder and this was opened and drained of chocolate-coloured pus, as in the case of the arm. On the third day after starting sulphathiazole the patient's temperature became normal and remained normal. His general condition also improved remarkably and he made an uninterrupted recovery.

### Summary

A case of pyæmia successfully treated with sulphathiazole (M. & B. 760) is described. The blood culture was sterile, but it is thought that the causal organism was probably a staphylococcus. Sulphanilamide and sulphapyridine were employed but did not have any appreciable effect. Sulphathiazole combined with surgical drainage resulted in cure.

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## BLACKWATER FEVER IN THE HILLS

By JAGADISH C. BHATTACHARJEE, L.M.P.  
Darjeeling Himalayan Railway Hospital, Tindharia,  
Darjeeling

BLACKWATER fever is pre-eminently a disease of the plains, where malaria is endemic, but recently a case has been encountered at Tindharia, an industrial town on the Himalayas, 2,800 feet above sea level, where indigenous cases of malaria are very seldom met with.

A Nepali boy, æt. 10, was admitted as an in-patient on 11th February, 1941, for treatment of a sprained elbow. He was otherwise healthy and had no other complaint till 16th February, when he was found to have suddenly passed about 6 ounces of dark urine in the early morning. The temperature was found to be 100°F. and it rose to 100.5°F. towards the afternoon. Spleen or liver was not enlarged. He complained of pain in the loins and nausea, but could retain food and drugs by the mouth. Passage of urine was free,



coffee colour, and about 40 ounces were passed in the first 24 hours. It contained hæmoglobin in solution. Examination of blood films showed *Plasmodium vivax* rings and gametocytes.

The patient had no history of fever, at least recently, and he had not taken quinine as he was under our observation in the hospital for about a week.

He was given alkaline mixtures, glucose and soda drinks, and quinine tablets (May and Baker)—two tablets of 0.1 gm. divided into three doses. He was also given an intravenous injection of 25 c.cm. of 25 per cent glucose solution with 5 c.cm. of 10 per cent calcium gluconate solution. Injection of glucose solution was repeated in the evening.

17th February.—Temperature between 98.4°F. and 100°F. Urine—about 25 ounces in 24 hours. Patient developed jaundice, hiccup and vomiting and could hardly retain anything by the mouth. Treatment same as before supplemented by rectal saline with glucose. An attempt was made to administer fresh decoction of leaves of *Vitex peduncularis* but the patient could not retain it because of frequent vomiting.

18th February.—Temperature between 98.4°F. and 99°F. Urine less than 20 ounces; colour red but intensity lessened. Vomiting and jaundice increased. Liver became tender and slightly enlarged. Treatment same.

19th February.—Temperature normal throughout the day. Urine comparatively clear but amount still diminished. Nausea still persistent. Treatment same.

20th February.—Urine brown. No fever. Quinine only one tablet given. Blood films were examined but no parasites were found. Patient became anæmic.

Recovery was uneventful and he was discharged cured on 23rd February, 1941.

#### Points of interest

(1) Occurrence of blackwater fever at an altitude of 2,800 feet where malaria is a rarity especially at this season of the year.

(2) Sudden appearance of hæmoglobinuria with slight rise of temperature in a subject, who had no history of recent fever nor quinine intake, but whose blood contained malaria parasites.

(3) Quick response to ordinary routine treatment plus quinine (May and Baker), which acted on gametocytes as well.

I am grateful to Dr. S. K. Biswas, Head of the Medical Department, Darjeeling Himalayan Railway, for his interest and suggestions in the treatment of the case.

[Note.—The important point is surely not where the patient first showed symptoms of blackwater fever, but where he acquired the infection that caused the blackwater. The writer gives no history of the previous movements of the patient. It is unusual to get blackwater fever with a benign tertian infection; it is however very difficult to be certain that the infection was not a mixed one.—Editor, I. M. G.]

#### OMENTAL LIPOMA

By HUKAM CHANDRA, M.B., B.S., P.C.M.S.  
Assistant Surgeon, in-charge Civil Hospital, Jhang  
(Punjab)

K. B., aged 31 years, female, consulted me in the early half of October 1940 for the following complaints:—

- (1) Amenorrhœa—duration two years.
- (2) Progressive enlargement of abdomen—duration ten months.

She had been examined several times by native dais who had diagnosed pregnancy as the cause of abdominal enlargement. She had also experienced the usual symptoms of pregnancy, such as nausea, vomiting and fetal movements but because the expected delivery

did not come about and appeared to have been delayed much beyond the usual period of gestation, the patient and her relations felt anxious about it and fearing grave abnormality consulted a lady doctor who discovered the absence of pregnancy altogether, but gave no opinion as to the cause of enlargement of the abdomen.

*Previous history.*—Married at the age of 13; commenced menstruating a year later. Suffered from more or less continuous fever for six months—probably of enteric origin—two years after marriage; recovery from this illness was followed by good deal of increase in weight. Menstrual history normal for fifteen years during which period she never conceived. Two years ago menses stopped abruptly and the patient was believed to have become pregnant but nothing happened to support this belief. Fourteen months after this the abdomen began to enlarge and the symptoms of pregnancy appeared in due course.

*Physical examination.*—Patient rather obese. Abdomen enlarged to the size of full-term pregnancy. Palpation revealed a tumour, semi-fluctuant in consistence, rounded and lobulated in outline, freely movable and most prominent on the right side below the umbilicus, but no fetal parts or movements could be felt and auscultation of the abdomen was also negative. Breasts were fully developed and contained milk which could easily be squeezed out of the nipples. Examination per vaginam negative except some fullness in the posterior vaginal fornix. Bowels regular and digestion good. Nothing abnormal about the heart, lungs or other organs. There was nothing to support the hypothesis of pregnancy and a provisional diagnosis of right ovarian cyst was made.

Operation was advised but the relatives of the patient insisted upon more definite exclusion of the possible existence of pregnancy. X-ray examination was suggested and done; the skiagram showed no evidence of pregnancy.

The patient was admitted into the civil hospital, Mailsi, on 8th November, 1940, and operated upon on the following day. The abdomen was opened under chloroform anaesthesia by a median incision below the umbilicus. Immediately on cutting the peritoneum a fatty tumour presented in the wound. Closer examination revealed this to be a lipoma encapsuled by the great omentum; it was decided to remove the tumour which consisted of two main lobes connected by a neck of fatty tissue. The whole mass was shelled out and bleeding points secured and ligatured. The margins of the cavity left in the omentum were brought together and sutured with fine silk. Examination of the uterus and ovaries showed nothing abnormal, and there were no adhesions between the omentum and coils of intestines. The abdomen was closed in the usual manner.

There were no apparent post-operative complications and the wound healed by first intention. Skin stitches were removed on the ninth day after operation when a soft fluctuant area was felt underneath the otherwise healed-up wound. A hæmatoma was suspected and confirmed by making a small opening through the lower part of the wound. About 3 ounces of fluid blood were mopped out, when the incision made through the peritoneum and muscular aponeurosis was seen to have healed up. Obviously the source of blood was from minute vessels in the subcutaneous fat which was present in abundance. The cavity left by the hæmatoma filled up slowly by granulation and the patient was discharged cured on 15th January, 1941.

*Comments.*—The occurrence of lipomata of any size (the one in the present case weighed 26 ounces) in the omentum is very unusual and I failed to find any reference to such cases in the literature on the subject available to me. Fatty herniæ of the linea alba and subserous lipomata are, in my opinion, entirely different from the one described above. The appearance of the usual symptoms of pregnancy, though



significant in this case, is not uncommon under similar conditions.

My grateful thanks are due to Captain D. D. Kapur, civil surgeon, Multan, for his permission to publish this report.

## ITCHING IN SYPHILITIC SKIN ERUPTIONS

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Irwin Hospital, New Delhi

and

R. K. SEN, M.B., B.S.

House Physician

THAT there is no itching in syphilitic skin eruptions is so well known that the mere presence of this symptom is thought to be enough to exclude syphilis in diagnosis. The case in point was interesting for this; he had a skin rash which was very itchy, and the diagnosis ultimately turned out to be secondary syphilitic skin rash.

*Case report.*—A male, aged 20, was admitted to the Irwin Hospital on the 8th January, 1941, with the complaint of itching all over the body. The trouble started a few days back and was more-or-less generalized from the very beginning. There was no history of contact with a case of scabies, nor of syphilis. Patient has no history of having taken any drug like arsenic, etc.

*Examination.*—There was a skin rash distributed all over the body—limbs, trunk and face. It was most marked over the left arm where the skin between the



Photograph of the case of syphilitic rash showing the vesicular eruption with a black top.

individual lesions was also somewhat inflamed. The lesions were also present in between the fingers and toes. The volar aspect of the wrists was not involved. Evidence of itching was present in the form of scratches.

The individual lesions were small discrete vesicles with a pointed top which in many instances simulated very closely the black-topped lesions of scabies.

There was no evidence of a syphilitic sore on the penis but the epitrochlear nodes were markedly enlarged. There was no pyrexia, and the heart, lungs and abdomen showed no abnormality.

*Laboratory findings.*—Scraping was taken for *Sarcoptes scabiei* but was negative.

Blood: hæmoglobin 60 per cent, leucocytes 6,875 per c.mm., polymorphonuclears 60 per cent, lymphocytes 24 per cent, eosinophils 11 per cent, large mononuclears 5 per cent, Kahn's test was three plus.

Urine analysis revealed no abnormality.

*Discussion.*—Resemblance to scabies was marked from the type of lesions, their presence in the clefts between the fingers and toes, and the presence of marked itching. But the presence of the lesions on the face and their absence on the volar aspect of the wrists was strongly against this diagnosis. A negative scraping excludes this disease altogether.

Before the result of Kahn's test was known, itching was strongly against the diagnosis of secondary syphilitic rash. In fact, during the time we were waiting for the blood examination, we had actually put the patient on treatment with sulphur ointment. This gave no relief. The itching persisted but the vesicles were rubbed down during the application of the ointment and the lesions became more macular.

After the blood report was available, the patient was given three weekly injections of neosalvarsan each dose being 0.45 gm., as only these doses were available. The itching improved considerably after the first injection, and so also the rash; until now, after the third injection, there is no itching and the skin lesions have also disappeared. In some places, especially the thighs, there is some pigmentation left. The patient is now getting bi-weekly injections of bismostab.

The blood examination and the result of treatment leaves no doubt as to the cause of the skin eruption. It was syphilitic. The interesting point was the itching which led to difficulty in diagnosis and mistake in treatment. We have felt inclined to report this case because of this. An odd case of syphilis may have itching as demonstrated by this example and we should be open-minded on this question, because sticking blindly to the orthodox view that syphilitic lesions do not itch might lead to an error like this. Itching should be regarded as a point against the diagnosis of syphilitic skin lesions but when other data point to this disease itching alone should not exclude it.

*Acknowledgment.*—Our thanks are due to Lieut.-Colonel M. M. Cruickshank, I.M.S., chief medical officer, Delhi, for his kind permission to report this case.

## A CASE OF LEUCOPENIA WITHIN TWENTY-FOUR HOURS OF THE INITIAL ADMINISTRATION OF PARASULPHANILYL-AMINOPYRIDINE

By A. T. M. GLEN

CAPTAIN, R.A.M.C.

Combe Regis, Mussorie

THERE have been in recent times many discussions about the toxicity of the various drugs of the sulphonamide group. Little, however, is

known as to the ætiological factors causing the leucopenia, which occasionally follows administration of these dyes; but it is fairly well substantiated that leucopenia follows large doses rather than small.

The writer encountered an interesting case treated with small doses of para-sulphanilyl-aminopyridine in which leucopenia ensued within 48 hours of the initial dose of the dye.

On 4th August, 1940, 'J. O.', a healthy male European of 28 years, awakened with severe abdominal pain and backache. There was no history of frequency of micturition, but a definite history of nausea, vomiting and constipation. In this state he was admitted to hospital and after abdominal and urinary examinations were carried out a diagnosis of pyelitis was made.

#### Urinary examination

Specific gravity	..	1018
Albumen	..	Trace
Sugar	..	Not present
Deposit	..	A few pus and red blood cells were present.

#### White blood cell examination

Total white blood cells	..	9,000
Polymorphonuclears	..	87 per cent.
Lymphocytes	..	6 "
Large mononuclears	..	6 "
Eosinophils	..	1 "

During the day of the 4th August 6 grammes of 2-sulphanilyl-aminopyridine were administered, and the temperature which had been 100°F. settled to normal on the morning of 5th August.

On 5th August the patient felt much better and did not complain of any of the symptoms associated with the toxicity of the sulphonamide group—cyanosis, dyspnoea, nausea, vomiting or palpitation.

The total white blood cells were 9,000, but a differential count was not made.

The urine when centrifuged showed as many as 4 to 6 pus cells and 2 to 3 red cells to a field; calcium oxalate crystals were also present. Six grammes of para-sulphanilyl-aminopyridine were administered orally during the 24 hours.

On 6th August 2 grammes of the dye were administered before the total white cell count was discovered to be 4,800 with the following differential count:—

Polymorphonuclears	..	53 per cent.
Lymphocytes	..	42 "
Large mononuclears	..	4 "
Eosinophils	..	1 "

The urine on centrifugalization only contained very few pus cells, no red blood cells and some amorphous phosphate.

In view of the leucopenia the para-sulphanilyl-aminopyridine was immediately discontinued, although the patient showed no signs of toxicity. On 8th August the patient developed a urethritis, the pus from which, on direct smear, showed Gram-negative intracellular diplococci. The total white cell count had risen to 7,600, with the following differential count:—

Polymorphonuclears	..	66 per cent.
Lymphocytes	..	26 "
Large mononuclears	..	5 "
Eosinophils	..	1 "

The gonorrhoea was treated with para-sulphanilyl-aminopyridine; 3½ grammes were administered on the 8th August.

On morning of the 9th August 2 grammes were given and the total white cell count was 4,600, whilst the differential count was:

Polymorphonuclears	..	43 per cent.
Lymphocytes	..	54 "
Large mononuclears	..	3 "

In spite of the hæmatological signs of toxicity there were no abnormal symptoms or signs of general toxicity.

The dye was immediately discontinued for a second time and the gonorrhoea treated by other means.

On 11th of August the patient still showed no manifestations of toxicity, other than a total white count of 4,000; no treatment was given for the leucopenia and on 13th August the white cells had risen to 7,600.

The patient was discharged from hospital on 26th August, with the condition relieved.

#### Summary

1. It is observed that on two occasions a leucopenia followed the oral administration of small doses of para-sulphanilyl-aminopyridine without the patient complaining of any abnormality and without the clinician observing any signs of toxicity.

2. Damage to the cells of the bone marrow by this group of drugs will cause permanent blood disease, and this damage can only be detected by frequent and regular white cell counts.

3. Fourteen grammes of the dye had been administered when the leucopenia was first detected, whilst only 5½ grammes were required to produce the second leucopenia.

4. In both cases immediate discontinuance of the drug resulted in a rapid return to the normal count.

#### A THORACOPAGUS MONSTER

By B. R. RANGANATHA RAO, L.M.P.

Sub-Assistant Surgeon, Mysore Medical Service, Kumsi

A PHOTOGRAPH of a thoracopagus monster recently given birth to by a 4th para.



One noteworthy point is that the patient's mother and sister delivered 'short-lived' twins in their 4th pregnancies.

# Indian Medical Gazette

JULY

## HOURS OF WORK

THE attitude of individuals towards work varies considerably; some view work as the main disadvantage of life, others as the only thing that makes it bearable; some would never do a hands-turn of work if they could help it, others will work all day while there is work to be found and their energy lasts. Whilst in any country both extreme classes, and all the intermediate grades, are usually represented, national and racial characteristics determine which end of the scale is most heavily represented in any one country. These characteristics are developed, mainly though not entirely, by the influences of environment, over a long period. Basically, man only works to obtain food; if nature is kind and he only has to scratch the ground and throw down a handful of seed to obtain an abundant crop, his idea of the working day is that it should not last more than a couple of hours, and the female of the species who is engaged on domestic work for a greater part of the day does not gain the male's respect but rather his contempt. Where nature is less kind and man has the elements to contend with, his working day tends to be much longer. Climatic conditions also play an important part in the determination of these characteristics; the hot climate of our first example not only makes long hours unnecessary, but it makes man disinclined to work, especially in the heat of the day, and this disinclination has a sound physiological basis. Conversely, in the cold north, man not only has to work harder to produce his food requirements, which are incidentally greater, and to protect himself from the cold by making clothes and building houses, but also his inclination to work is greater because work keeps him warm.

India is a large country and can produce climatic conditions parallel to those of almost any part of the world, so that generalizations regarding the peoples of India are dangerous; nevertheless we will risk the statement that as a whole the natives of India, though they do not share that restless inclination to work hard or play hard that is the characteristic of those of northern Europe and America, they have no deep-rooted objection to hard work. This is obvious from the amount of labour that is recruited in India for surrounding countries.

When the British came to India they brought with them a number of their own habits, and with characteristic British obstinacy they stuck to them even though many were unsuited to the climate in which they were then living. These included the wearing of heavy and unsuitable

clothing, eating heavy meals and drinking heavy wines particularly in the middle of the day, and unsuitable hours of work; these habits were undoubtedly an important factor in determining the very high death rate that occurred in the British army and amongst British civilians in this country. The latter is reflected on the tombstones in many old Christian cemeteries in this country, for example, in the now-famous Park Street cemetery in Calcutta in which a high percentage of the deaths are amongst men and women between the ages of 20 and 30. Of these habits the only one that they imposed upon Indians who worked for and with them were their habits regarding hours of work.

Wisdom has prevailed and the British in India have given up many of these unsuitable habits; the European to-day certainly works harder and longer than did his predecessor of a hundred years ago, but he has many compensatory amenities that make this longer day possible; he has however adopted, in many places, especially in the mofussil, a more suitable distribution of the hours of work. In the army, for example, during peace-time, work starts at dawn and stops in the middle of the day. A similar plan is adopted in many hot up-country non-military stations where the community is a compact one and nobody lives very far from his work. Under such conditions it is possible to arrange a good day's work in the early morning and evening, leaving the middle of the day for rest. But even under these conditions there is an objection to this plan, especially where the sedentary worker is concerned; for besides the foreign customs to which we have referred, the British have also brought with them an adage about 'all work and no play making Jack a dull boy', and the habit of playing games is one that has been readily adopted by Indians. If the coolest part of the day is to be taken up by work what time will remain for games? Certainly not the middle of the day, for if that is unsuitable for work it is more unsuitable for games. And when does the sedentary worker get his exercise?

For many years there has been a periodically recurring agitation for a revision of the hours of work in the large Indian cities. This agitation is nearly always started by a new-comer, either a new arrival in India who has perhaps been influenced by Noel Coward's satire 'Mad dogs and Englishmen go out in the midday sun', or someone who has previously had little experience of town life and has appreciated the advantages of earlier hours of work in his up-country experience, but it seldom results in more than the publication of a few letters in the papers or a short-lived local experiment. Now why is this? Surely, it is more than ever necessary in a big town where the buildings hold the heat and shut off the air currents that work should cease in the middle of the day. Is it just stupid conservatism, and refusal to modify

the habits of generations (though not of centuries, it should be remembered) that opposes any change, or is there reason in the opposition? Conservatism is undoubtedly an important factor, but there is very considerable reason on the side of the majority who have always opposed any drastic change. The reasons against a change will depend of course upon what the change is. We will revert to this later.

'Hours of work' has again come into the news, metaphorically: actually very little about it has appeared in the public press. On this occasion, there are special reasons for the revival of this agitation—the war and the 'black-out'. It is important that as many people as possible should reach their homes before darkness falls, and this can only be ensured by advancing the hours of commencing and finishing work.

#### *Some suggestions*

The Director of Public Health (DPH), Bengal, has subscribed to the controversy, and in a pamphlet entitled *Time of work* has made some astonishing suggestions. The hours of work that he has proposed are from 6-30 to 11-30 a.m. with a return between 4 and 6 p.m. to do 'urgent work'. He has not made it very clear what constitutes 'urgent work'. Whether, for example, it means work that has arisen during the day. If this is the interpretation then presumably the office worker will have to return at 4 p.m. daily to see if there is any 'urgent work'. Or does it refer to work that has already lain on his table for a month and can be put off no longer? If the latter, who decides whether the work must be considered 'urgent'? No, we are afraid that the DPH is not facing facts quite squarely; he is either suggesting that the working day in Bengal should be reduced to five hours—a suggestion that it is very difficult to take seriously—or that the office worker should return in the evening to finish his day's work. He cannot have it both ways.

However, none of the arguments in favour of his suggestion visualizes a return to work in the afternoon, and we are not surprised at this, for, in a city where a large percentage of the clerks live an hour to two hours' journey from their place of work, it would mean that, during the midday break, 11-30 a.m. to 4 p.m., they would have to remain in or near their offices, or spend the hottest part of the day rushing home, taking a hurried meal, and rushing back again, which, to borrow from the physiology of the DPH, would mean that their blood rushed to their limbs, then to their stomachs, and back to their limbs again, so that there would be little left for their brains when they did get back to work in the evening. As far as Calcutta is concerned this is a totally unpracticable suggestion, from that of health and from every other point of view.

The two points that the DPH makes in favour of earlier hours are with reference to

temperature and humidity; he argues, quite rightly, that high relative humidity is almost as detrimental as high temperature. He then develops his argument by pointing out that the temperature is lower in the morning—this is of course quite true—but he adds that humidity is also lowest in the mornings, a statement that is in direct opposition to experience at the meteorological office in Alipore, and is so surprising, coming as it does from the Director of Public Health of a large province, that, lest we have misinterpreted his words, we will quote them in full:—'If we cannot attain the optimum of 60 per cent, we should at least try to be as near it as is possible, and on the average, it is likely to be much less in the mornings'. Again he says, 'the temperature and, usually also the relative humidity are low in the morning'.

Chart 1 was drawn from figures which originally came from the meteorological office,

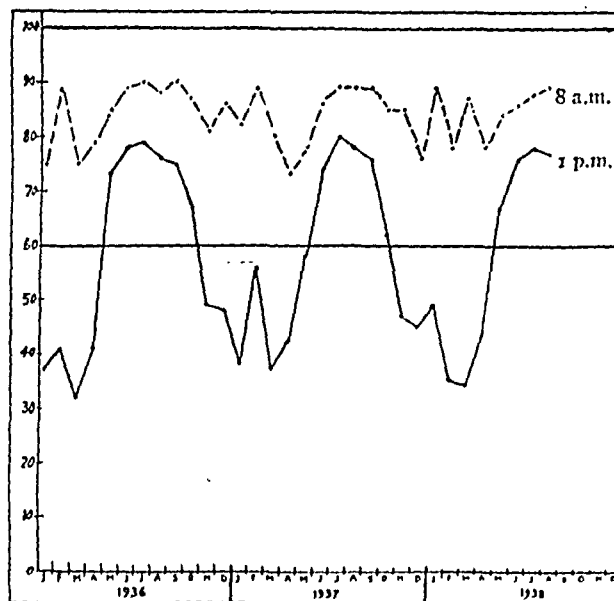


Chart 1 showing the monthly mean relative humidity at 8 a.m. (broken line) and at 1 p.m. (continuous line), during three consecutive years.

Alipore, and which happened to be at hand. They show that in no single month was the average relative humidity at 8 o'clock in the morning less than 10 per cent higher than the corresponding humidity at 1 o'clock in the afternoon, and that for many months in the year it was 40 per cent lower in the middle of the day than in the early morning.

Charts 2, 3 and 4 are from data very kindly supplied by the Director of the Meteorological Survey—at a few hours' notice on a telephonic request; they show the normal average dry bulb temperature, wet bulb temperature and relative humidity, respectively, throughout the day, for three representative months of the year. The five-hour day of the DPH and the present secretariat hours are shaded. The relative humidity chart scarcely adds support to the

claim that his hours would mean work under conditions closer to the ideal humidity of 60 per cent; in fact exactly the contrary is obvious. We do not claim that these charts refute his case for earlier hours; we only point out that, when he picked relative humidity to support his argument, he was backing a loser. Judging the case from these three charts alone, the balance is in favour of the early hours in the hot-weather months (represented here by March), there is little to be said either way as regards the monsoon months (represented by August), and in the cold-weather months the temperature at 7 a.m. (the DPH's modification for the cold weather is 7 a.m. to 12 noon) is a long way below the ideal, which according to the DPH is 75°F., and is in fact uncomfortably cold.

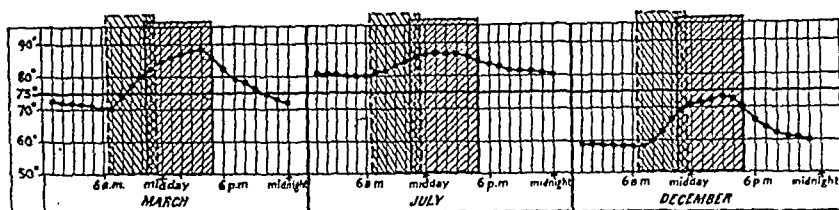


Chart 2 showing the normal diurnal range of dry bulb temperatures.

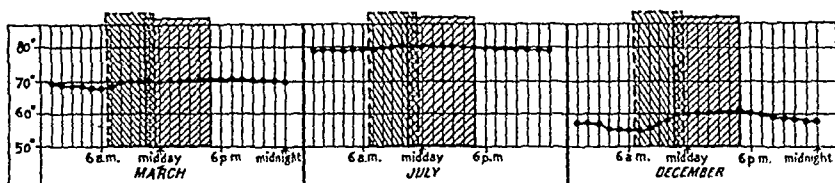


Chart 3 showing the normal diurnal range of wet bulb temperatures.

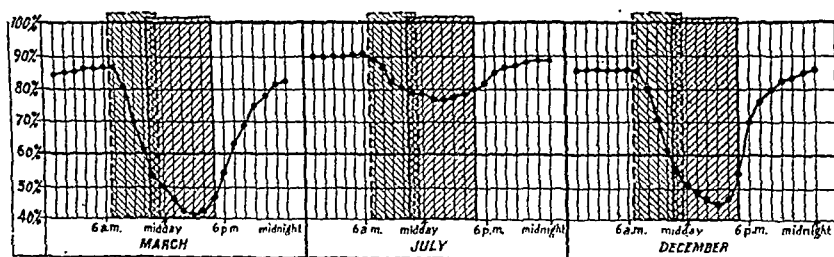


Chart 4 showing the normal diurnal range of humidities.

In heat loss, an essential part of temperature regulation, there are four important factors, namely, the temperature of the air, the humidity of the air, the movement of the air, and insulation. The importance of these factors is in the order in which they are given, but none can be ignored. There is no logical formula by which maximum comfort, and therefore optimum conditions for work, can be calculated; all the data on the subject that have been collected are based on practical trial, and are therefore subject to the fallacy of the personal factor. The data, though very considerable, have mostly been collected in America and must therefore be applied here with reserve.

To express the effect of three climatic factors, temperature, humidity and air movement on the

body sensations, a term 'effective temperature index' has been introduced. The unit of expression is an arbitrary one, but, as it is usually calculated from Fahrenheit temperatures, it is usually given in terms of Fahrenheit degrees.

This 'effective temperature' is a very much better expression of the effect of the climatic conditions on the human body than either the dry bulb or the wet bulb temperature, and in fact in our present state of knowledge it is the best standard for judging this effect that we have. The charts that are available for calculating effective temperature were prepared in America and are based on certain standard conditions, with regard to clothing in particular, that are not quite paralleled in this country. For example, the summer clothing in general use in America is light, but not as light as we use here. Again, there is the difference between the European style of clothing and the Indian style, as well as the individual and seasonal differences, and altogether this factor is so complex that it is impossible to give it any accurate mathematical expression. As we noted above, this matter of insulation, which is the effect clothing has, is the least important of the factors affecting loss of heat; it is thus better to ignore it, and to assume that the person concerned will adapt his form of clothing to the prevailing climate.

The next point to be considered is, what is the optimum effective temperature? Or perhaps it is more important to know what is the 'comfort zone', above which one is too hot and below which too cold? Even on this simple matter, we have not yet collected figures in India, though the subject is being studied. Naturally this will vary according to what one is doing, but most figures are based on the individual being seated at a table writing, or doing light work. The personal factor will also come in, but this is eliminated in the calculations by taking a large number of observations. The observations that have been made on the racial factor are interesting and often paradoxical. For example, it was found in a large office in China that the Cantonese clerks had a lower comfort zone than the Europeans. On the whole, both the racial and the acclimatization factors are surprisingly unimportant.

Even in American cities, the optimum effective temperature has been shown to vary between 66°F. and 72°F., with the 'comfort zone' extending about five degrees above and below the

optimum figure; in India, we can tentatively place the optimum at the highest of these figures, with the comfort zone from 67°F. to 77°F. effective temperature.

Chart 5 shows the effective temperatures throughout the day during the three representative months that we have taken, and the hottest month, May. The arbitrary comfort zone is marked out, also, the five-hour day suggested by the DPH and the present secretariat day.

Now to return to the question of hours of work, if we are going to base it entirely on the favourability of climatic conditions we must be prepared to change our hours frequently. The present (secretariat) hours are obviously almost ideal for the cold-weather months, as the lower edge of the comfort zone is reached about 11 o'clock and conditions remain within this zone until about 4-30 p.m. Whereas if one followed the suggestion of the DPH one would not be comfortably warm until it was nearly time to leave office.

In March the converse is the case and conditions during the present office hours are wholly outside the comfort zone; the best hours are from midnight to 7 a.m. but up to 11 o'clock the conditions are still within the comfort zone. In July the whole day is well outside the comfort zone and there is only  $4\frac{1}{2}$  degrees between the best and the worst hours. Similarly in May, the hottest month of the year, the conditions during the whole 24 hours are well above the comfort zone, but the difference between the best and worst hours is not very great.

Let us consider March first. Obviously it would be totally impracticable for the clerk to work from 12 midnight to 6-30 a.m., or even to start work at dawn, but is it possible for him to start at 6-30 a.m. as the DPH has suggested? In the vast majority of cases we believe it is not practicable. He has a long day's work in front of him and he must take some food before he starts. Even if he has someone to cook his food for him (and many have not only to cook but to buy their own food), he can scarcely get up, wash, dress, and take his food in reasonable comfort and decency in less than an hour and a half; if then he has an hour's journey to his office—this is putting it at a low figure—he will have to get up at 4 o'clock. So we must put the earliest reasonable hour for starting work at 7-30 a.m.; even this will be a considerable hardship to many. To put in the full  $6\frac{1}{2}$  hours, he must work until 2 p.m., and if emergency

work arises he may have to put in another two hours (this very often happens in commercial offices, even if it is rare in government departments), which would mean his working through the worst hours of the day.

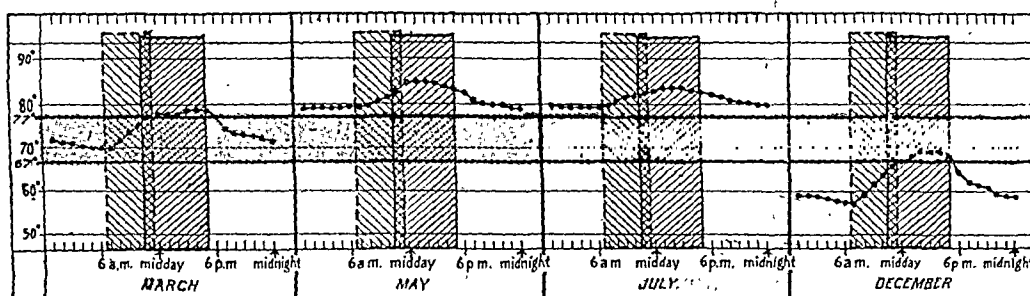


Chart 5 showing the normal diurnal range of effective temperatures.

Very much the same argument can be applied to the later hot months, for example, May; there would admittedly be a slight advantage from the point of view of effective temperature in starting work at 7-30 a.m., but one could not avoid the worst hours of the day. Even during these early hours the temperature is well above the comfort zone, and the difference between the best and the worst is not very great, and in the monsoon months this difference is reduced still further.

It is therefore only in the intermediate period between the hot and the cold weathers that there would be any real advantage in making any drastic change in the working hours; for the hottest months and the monsoon months we must face the fact that Bengal is a hot country in which one may expect the temperature to be outside the comfort zone for the 24 hours of the day, so that we cannot avoid the heat however we juggle with our working hours. The slight advantages to comfort during working hours that might be gained by a drastic change would be outweighed by the dislocation of the established custom that would reflect on the health and happiness of the vast majority of workers.

We do not mean to suggest that some change is not advisable. If the office hours could be advanced by an hour, or even two hours where they are now very late, it would, we believe, be to the advantage of the worker, and therefore of his work. The slightly earlier start would not entail any hardship when habits had been adjusted, the earlier closing hours would give the worker who lives near his work more time for games and exercise, and allow those who live some distance away to get home in the daylight.

This adjustment could best be made by altering the clock. We could scarcely call it 'summer-time', or 'war-time', and even 'black-out time' might be misleading. We leave the choice of name to some more fertile imagination, but meanwhile we suggest putting forward our clocks by at least an hour.



## Special Articles

## HÆMATOLOGICAL TECHNIQUE

## PART XII\*

By L. EVERARD NAPIER, F.R.C.P. (Lond.)

and

C. R. DAS GUPTA, M.B. (Cal.), D.T.M.

(From the School of Tropical Medicine, Calcutta)

*The investigation of a case and the reporting of results*

THE question that we are frequently asked is, what do you consider the minimum examinations that should be carried out in a case of anæmia? We should be forced to reply that, with the exception of those in part X, which apply particularly in hæmorrhagic diseases, at least all the examinations that have been described in this series should be made for the proper investigation of a patient.

In actual practice, nearly all the blood examinations can be carried out from a single specimen of blood and do not take a good technician more than an hour, if the Price-Jones curve is excluded. A certain amount of time can be saved by omitting the Arneht count, the fragility test, and the enumeration of thrombocytes, and there are many circumstances in which these tests will give little information of practical value. This leaves the hæmoglobin estimation, the total red and white cell counts, the reticulocyte count, cell volume percentage estimation (hæmatocrit) and sedimentation rate, van den Bergh's reaction, and white cell differential count, to be done as a minimum routine procedure in every case.

The findings will indicate whether these examinations should be supplemented. Sternal puncture gives very valuable additional information, but it must not be considered as a short cut to diagnosis for it will seldom be of any value without a complete blood count, and further the identification of the various cells is very skilled work that necessitates considerable experience.

There will be occasions when electric current is not available and in these circumstances it will not be possible to estimate the cell volume percentage satisfactorily. Although the mean corpuscular hæmoglobin (MCH) usually runs more-or-less parallel with the mean corpuscular volume (MCV), it will be advisable to make

some measurement of the red cells, and, as in our experience clinical halometers are very inaccurate, the mean cell diameter should be measured by the modification of Price-Jones method that we have described.

The inclusion of the erythrocyte sedimentation rate (ESR) in the minimum procedures might be questioned, but, if a Wintrobe's tube is used for cell-volume estimations, the ESR requires no additional apparatus and entails no extra labour, except the taking of a reading at the end of an hour, and the information it gives is often useful.

Gastric analysis is important when the question of pernicious anæmia arises and in some cases of microcytic anæmia of doubtful ætiology, but we would not give it a high place in the order of importance, in the investigation of cases of anæmia in this country.

For the complete investigation of the ætiological factors many other examinations will have to be carried out, e.g., the urine for albumin, blood, and ova; the stools for protozoa, helminths, and pathogenic bacteria, for fat content, and for the presence of occult blood; and the blood for 'blood grouping', the Wassermann reaction, cholesterol, albumin/globulin ratio, etc.

*Controlling progress.*—Circumstances will usually dictate how often blood examinations should be carried out during treatment, but there are certain points which we will consider here.

In the first place, when a seriously-ill patient is admitted into hospital, he is often suffering from some degree of hæmo-concentration, and a second examination made a few days after admission shows a marked drop in hæmoglobin percentage, whereas the patient's condition may have improved considerably. If allowance is not made for this fact, the effect of the first treatment that is given may be misjudged, and we have always adopted the practice of making a second examination before prescribing specific treatment (except in urgent cases where an immediate blood transfusion is indicated).

Further, there are many nutritional anæmias in India in which there is a steady improvement directly the patient is put to bed and given a good diet. Allowance must also be made for this fact, if the value of any special form of treatment is being estimated and, in such circumstances, at least two weeks of rest and diet should be allowed before the specific treatment is started.

We make a practice of repeating the blood examination, including hæmoglobin percentage, red cell count, reticulocytes, cell volume percentage, van den Bergh's reaction, and ESR, and examination of the film for abnormal cells, once a week, or earlier if a setback is suspected or if the treatment is to be changed. In special cases other examinations, such as the platelet and leucocyte counts, are also repeated.

When any specific form of treatment is given a reticulocyte count is done daily from the 4th until about the 12th day, or, in a case where

\*It was not the original intention to publish another article in this series. These notes were written as the final chapter of *Hæmatological Technique*, the booklet referred to in our editorial note in the May number. On reconsideration, we have decided that it will make this series more complete, if we reprint these notes and the forms here.

*Hæmatological Technique* is now on sale, and may be obtained from Messrs. Thacker, Spink and Co. (1933), Ltd., Esplanade, East, Calcutta.



there is a reticulocyte crisis, until the reticulocyte percentage has fallen to its previous level.

The printed forms that we use in the School are shown below. There is quite possibly room for improvement in these forms, and we have modified them from time to time, but we find that, without being cumbersome, they are sufficient for our purpose.

*Form 1* is the ordinary report form which is sent to the ward and attached to the notes (size  $8\frac{1}{2}$  by  $6\frac{1}{2}$  inches).

*Form 2* is the sternal puncture report form, similarly sent to the ward and attached to the notes; a résumé of this is entered on the reverse of form 3 (size  $8\frac{1}{2}$  by  $5\frac{1}{2}$  inches).

*Form 3* is the card which we keep in the laboratory. The important data on which progress is judged are entered on the face of the card, and other data and records of examination that are not usually repeated, on the reverse (size  $8\frac{1}{2}$  by  $6\frac{1}{2}$  inches—stiff card).

## FORM 1

S. T. M.

ANÆMIA DEPT.

## BLOOD REPORT

Name ..... Sex ..... Age ..... Ward ..... Bed .....

Hæmoglobin (Hellige normal hæmometer). per cent

Gm. per  
100 c.cm.

Red blood cells: per c.mm.

Reticulocytes per cent

Cell volume: per cent

Mean corp. volume: Cu.  $\mu$ .Mean corp. hæmoglobin:  $\gamma\gamma$ 

Mean corp. hæm. conc.: per cent

White blood cells: per c.mm.

per cent per c.mm.

Neutrophils

Lymphocytes

Large mononuclears

Eosinophils

Basophils

Arneth count, I II III IV V Weighted mean. Blood group.

Abnormal cells.

Platelets per c.mm.

Coagulation time. Bleeding time.

Fragility of red cells. Prothrombin time.  
Capillary resistance.Sedimentation { Observed  
rate (1 hour) } CorrectedVan den Bergh's { Direct  
test } Indirect mg. per 100 c.cm.

Opinion:

Date .....

## FORM 2

S. T. M.

ANÆMIA DEPT.

## STERNAL PUNCTURE REPORT

Name ..... Age ..... Ward ..... Bed .....

Total nucleated cells.....Reticulocytes.....

Endothelial cells:

Rcd cell series:

Megaloblast.....

Erythroblast.....

Macroblast.....

Normoblast.....

White cell series:

Granular series—

Myeloblast.....

Pre-myelocyte.....

Neutro. myelocyte { A.....  
B.....

,, meta-myelocyte.....

,, band.....

,, segmented.....

Eosino. myelocyte.....

,, meta-myelocyte.....

,, band.....

,, segmented.....

Basophil.....

Non-granular series—

Lymphoblast.....

Lymphocyte { A.....  
B.....

Plasma cell.....

Monoblast.....

Pre-monocyte.....

Large mononuclear.....

Megakaryocyte.....

Undifferentiated.....

Parasites.....

Date .....



Poisoning, both suicidal and homicidal in India, is very common when contrasted with the frequency with which it occurs in the countries of the West, and it must be remembered that in India the criminals are not always brought to justice. The intimate relations of the medical man with the family household place him in an unrivalled position for close observation of suspected cases, and he is sometimes able to avert tragedy. In our purdah quarters, the lady doctor can play a similar rôle.

#### *Early Hindu history of poisoning*

It should be of interest to us in India to know that the early Sanskrit medical writings contained in the *Ayurveda*, dated about 900 B.C., and the commentaries thereon (*Shastras*) of Charaka and Sushruta, dated about 600 B.C., indicate an extensive knowledge of poisons among the Hindus of that early period. The *Ayurveda* contained a division treating of the administration of antidotes for poisons, and the bites of venomous serpents, insects, etc. The *Shastras* of Charaka and Sushruta contain sections devoted to poisons and their antidotes in which the action of vegetable, animal, and mineral poisons are described, including a lucid account of alcoholic intoxication and the following is quoted to show that criminal poisoning was then guarded against:—

'It is necessary for the practitioner to have a knowledge of the symptoms of the different poisons and their antidotes. As the enemies of the Rajah, bad women and ungrateful servants, sometimes mix poison with food on this account the cook should be of good family, virtuous, faithful, and not covetous, nor subject to anger, pride or laziness.

The practitioner should have like qualities, with an intimate knowledge of poisons, and should examine the food to be eaten by a Rajah in the cook-house. This place should be large, airy, light and surrounded with faithful servants, and no one should be allowed to enter; unless he is first examined.

A person who gives poison may be recognized. He does not answer questions, or they are evasive answers; he speaks nonsense, rubs the great toe along the ground, and shivers; his face is discoloured, he rubs the roots of the hair with his fingers, and he tries by every means to leave the house. (Are these the present-day physical signs of a guilty conscience?) The food which is suspected should be first given to certain animals and if they die, it is to be avoided'.

#### *What is a poison?*

A poison is any substance which, when taken or given, is capable of seriously affecting health, or of destroying life. From the forensic standpoint it is, however, the intention to murder or harm which constitutes the crime, consequently the administration of substances not usually regarded as poisons may be poisons from the legal point of view if they are administered with evil intention.

#### *How does poisoning occur?*

- (1) Administration for homicidal purposes.
- (2) Self-administration for suicidal purposes.
- (3) Self-administration for a special purpose, e.g., abortion.
- (4) Accidental administration, e.g., wrong treatment, bad dispensing or an excessive dose amongst drug addicts.

#### *What is the motive for poisoning?*

The motive for poisoning in the Punjab is very tersely described in the three Persian words—*Zar, Zan* and *Zamin*, which being translated means money, woman and land. The motive is therefore quarrels over money, the irrigation and possession of land, or the possession of a woman. These motives may be some of the reasons why cases of homicidal poisoning are higher in the rural districts than in the towns. Still it must not be implied that there are more criminals of this type in the country districts, but

rather that a criminal is more likely to be found out since his private affairs are known in greater detail by his neighbours. In other words, the poisoner stands a greater chance of successfully evading detection in town than in the country. Again, the Indian poisoner lacks the craftiness often displayed by his confrère in the West; he commits his crime without premeditation and occasionally very crudely. Another point to be noted is that far more males commit crime than females, but the percentage of females using poison in India is greater than males.

The detection of poison in exhumed bodies, where medical treatment had been carried out before death, shows the difficulties and responsibilities of the medical practitioner. This practice of cremation in India amongst certain communities leaves a definite loophole whereby the poisoner can escape detection and it must be recognized that such successful poisoners frequently have more than one victim to their credit. How often have the police removed a corpse from the funeral pyre before it was completely burnt and a poison was detected in the unburnt portion of the human organs? How often has the body been so completely incinerated that it was not possible to detect poison in spite of the fact that the history pointed conclusively to some poison having been administered and having caused death?

#### *How to investigate a suspected case*

Poisoning in India is so common that every practitioner at some period must have attended a case. When he finds the victim is moribund and dying, the obligations of the medical practitioner in this country are simplified as he can call in the government medical officer who carries out the post-mortem examination and informs the police. If, however, the patient is only suspected to be a case of poisoning, the procedure is not so simple, particularly if he is a private patient who does not wish to be admitted to a hospital. The question is then what to do, how to do it and how to find out if your patient is being poisoned without arousing unnecessary suspicion. Most of the common poisons are excreted in the urine, therefore, if you take a morning and evening specimen for analysis, you may be able to confirm your suspicions without having to confide in others. Arsenic, mercury and most of the heavy metals are excreted rapidly by the kidneys. Certain other poisons, particularly opium, may be detected by their clinical signs such as the pin-point pupil, the cold clammy skin, stertorous breathing and possibly the smell of opium in the breath. When you are satisfied that your patient is the victim of poisoning do all you can to avert a tragedy and do not hesitate to call in another doctor to share the responsibility.

Your most likely poison in the Punjab will be opium and I am sure that you must have all seen such cases either in hospital or in your practice. Hardly a week passes without a case of opium poisoning being hurried into the Mayo Hospital for treatment.

#### *Statistics of opium poisoning*

Advantage was taken of the publication of the 1931 census report to work out the prevalence of opium poisoning for that year in the Punjab. In my annual report for that year opium was stated to account for roughly 45 per cent of all cases of poisoning. The conclusions reached from the statistical examination may be summarized briefly as follows:—

- (1) That the number of cases amongst males is three times that amongst females.
- (2) That this proportion is evenly distributed through all the major communities.
- (3) That the number of cases relative to population amongst Muslims, Hindus, Sikhs and Christians is roughly in the ratio of 1, 2, 4, 8. The native Christians have the highest ratio of cases to population and the Muslims the lowest.
- (4) That fatal cases number more than three times non-fatal cases. This indicates that opium as a poison is fairly reliable.

- (5) That suicidal opium cases occur amongst males more than three times more frequently than amongst females. This is an interesting fact, as suicides amongst females in India exceed that amongst males. Women in India resort to drowning or hanging in preference to poisoning.
- (6) That the most popular age for both sexes to commit suicide by taking opium is between 15 and 25 years.
- (7) The opium suicides amongst Sikhs are twice as frequent as amongst Hindus and four times as frequent as amongst Muslims.
- (8) That accidental poisoning in opium addicts is also more common amongst males than amongst females and proportionally higher in Sikhs than Hindus.
- (9) That cases of homicide by opium poisoning are extremely rare and only happen in very young infants, particularly illegitimate children.

Some years ago a police officer wrote to ask why opium which is so plentiful in the bazaars is not used for murder. I replied that opium for the person who wishes to pass beyond the portals of a world that has become unbearable but who would preferably take that journey by the least disagreeable route, presented so many advantages in its freedom from physical suffering, the ease with which it is obtained and its certainty in its effects as a poison that it had come to be known in the East as the favourite means of suicidal poisoning.

There are, however, many reasons why opium can never be popular as a poison for homicidal purposes:—

- (1) The bulk required, which is approximately 30 grains. This is the size of a small walnut. Addicts would require probably three times this dose or more.
- (2) Its bitterness, its smell and its dark brown colour are so well known in India that it would be recognized.
- (3) The time before unconsciousness sets in; the person can give warning and have himself treated.
- (4) Treatment is so simple and satisfactory. The stomach is washed out with a weak Condy's fluid solution and artificial respiration and stimulants applied if necessary.
- (5) There are so many more certain and popular poisons in India. It would be just as unnatural for an Indian to give opium to another for homicidal purposes as it would be for a European to give alcohol to one of his own race for the same object.
- (6) Poison as a liquid or a powder is more easily disguised than a sticky mass like opium.

All attempts at murder would not prove successful and those cases where recovery took place, would be brought to light and a charge of attempted murder would be framed. There are no such cases on record in the Punjab.

#### *Acute poisoning with potassium permanganate*

A youth, aged 17, in order to commit suicide, swallowed the mercury from a thermometer and then a tablespoonful of permanganate of potash with some water. On account of the burning and pain in his mouth and throat he drank quickly some glasses of water and immediately vomited and lost consciousness. On examination, he was deeply comatose, and the mouth and throat were pale violet in colour, with superficial abrasions. The pulse was slow and the breathing of the Cheyne-Stokes' type. The stomach was washed out and caffeine and lobelin administered. Some minutes later, the heart and respiration became normal, but the youth remained unconscious until the next morning. The day after, he was quite well.

Poisoning by potassium permanganate is of interest to us in India because this is the antidote generally given in cases of suspected opium poisoning and poisoning by opium is very common, as it is the favourite poison of the suicide. Whenever a stomach-washing is sent for analysis for the detection of opium and the washing contains potassium permanganate in

solution, the presence of opium cannot be detected, as the tests for opium are destroyed by the action of the potassium permanganate. However, this is not the point I want to bring out, it is far more important to save the patient's life than it is to be able to detect the presence of opium in the washings. The solution of potassium permanganate given as the antidote should be made into a weak solution, its colour should be faintly pink and the quantity used as a stomach wash is far more important than the actual strength of the solution. Repeated washing by means of the stomach tube of a weak solution has proved to be the most successful treatment in all such cases. In fatal cases we have received viscera in which the condition of the mucous membranes of the stomach conclusively proves that a very strong solution of potassium permanganate has been used, in fact there have been cases which left grave doubts as to whether the treatment was not worse than the effect of the opium, and had death not resulted from the opium it might have resulted from the effects of the strong solution of potassium permanganate administered as an antidote.

#### *Arsenical poisoning per vaginam*

Many cases have been received in the Chemical Examiner's Department where the attempt to procure criminal abortion by the administration of arsenic *per vaginam* has proved fatal to the mother and the child. Arsenic seems to be as readily absorbed by the mucous membrane of the vagina as it is by the mucous membrane of the stomach and the intestinal canal, and in those cases where the viscera have been submitted for analysis, the arsenic is found in the stomach, intestines, liver, kidneys as well as in the urine of the mother. The alimentary tract seems to reverse its action, i.e., the stomach in particular takes on the function of excreting the poison from the blood stream, thereby helping nature in eliminating the poison from the body by the process of vomiting and the intestinal tract endeavours to eliminate the poison by the process of purgation.

Civil surgeons should, therefore, submit all the viscera in a case of suspected arsenical poisoning *per vaginam* just as they would do in any ordinary case of acute arsenical poisoning which has been administered by the mouth.

#### *Chronic arsenic poisoning due to well water*

The water supply of a farm near Madoc, Ontario, was found to be naturally contaminated with arsenic. Several cases of chronic arsenic poisoning occurred among the inhabitants of the farm, and all were due to drinking water from the well, which was drilled to a depth of 94 feet through 'red rock' (a sandy limestone stratum) in 1922. The farmer living on this farm frequently suffered ill-health and was treated for anaemia, even yet he exhibits hyperkeratosis of the palms of the hands. In 1927 the farm was sold to a young man, who soon became ill, grew steadily worse, and in 1932 was diagnosed to be suffering from nephritis, although signs of arsenic poisoning were present. He died two months later. On the death of the farmer his brother took over the management of the farm, and after two years he, too, became ill. His sister-in-law, who had remained on the farm as his house-keeper, also complained of not feeling well, and in April 1935, she consulted a heart specialist, who diagnosed chronic arsenical poisoning. Meanwhile the brother, who had frequently complained of gastro-intestinal discomfort and pain, was referred by his physician to a surgeon, who diagnosed appendicitis, and performed appendectomy in June 1935. Following a brief period of convalescence he resumed work on the farm, and very soon his former symptoms—nausea, vomiting and abdominal pain returned. His suspicions were aroused and samples of water were sent to the Central Laboratory of the Ontario Department of Health. The report was to the effect that the water contained 7/10 grain of arsenic (expressed as arsenious oxide) per gallon. An investigation of the probable source of the arsenic showed that samples of limestone stratum, through which the well had been drilled, yielded as much as 15 parts arsenic

(as arsenious oxide) per million, or 1.05 grain per lb. A microscopical section of the limestone showed it to contain aggregates of brownish particles of an arsenate of iron. Similar particles were present in the scale from the household kettle, and the powdered scale itself contained 0.4 per cent of arsenic, as arsenious oxide. The clinical histories of the cases indicated that a period of approximately 2½ years was necessary to produce definite signs of chronic arsenical poisoning from the use of the arsenical water.

Although we in the Chemical Examiner's Department at Lahore have examined many samples of water from different parts of Northern India during the last 30 years, no sample of water has been received which contained even traces of arsenic. I believe that there are arsenic mines in Chitral but even the samples of water received from that district and examined on behalf of the military authorities for the troops, which are permanently stationed there, have never shown any traces of arsenic on analysis. It is reported that some of the waters from wells in Armenia and Georgia contain traces of arsenic and that the beautiful skins of the Armenians and Georgians, particularly the women, have been attributed to the traces of arsenic in the water supply. Arsenic is known to have a beneficial effect on the skin when taken in medicinal doses.

#### *In arsenic poisoning demonstration of poison in body not essential to conviction of homicide*

Three boys became ill with vomiting, nausea and cramp, after eating candy prepared and given to them by the defendant. A physician, although unable to diagnose their condition, prescribed a purgative and emetic to each. A few days later the illness was diagnosed by another physician as metallic poisoning, probably arsenic. One of the boys died 12 days after having developed paralysis ('drawn legs'). The defendant was convicted of murder in the first degree, and he appealed to the Supreme Court of West Virginia.

Expert medical witnesses who made an examination of the organs of the dead body testified that the inner surface of the stomach was red and irritated and covered with sticky mucus. There was no evidence of the presence of arsenic by chemical analysis. Considering the time which elapsed between the death of the boy and the taking of the poison (12 days) this might have been eliminated. The failure of the chemical analysis was not sufficient, the judge said, to exclude arsenic as the cause of death, the possibility of finding traces after the purgatives, emetic, etc., was less than if death had occurred within a few hours. Arsenic is not a strongly cumulative poison, it is temporarily deposited in the liver and other organs of the body after absorption, but it is rapidly eliminated from the system by the urine, bile and other secretions. Should the person survive for 2 or 3 weeks no trace of poison may be found after death, and it is not incumbent on the prosecution to prove that a quantity of poison sufficient to cause death was found in the body, before a jury can be allowed to find that it was the cause of death, if the evidence sufficiently establishes the fact that the poison alleged to have caused death did kill the deceased. Accordingly the court concluded that the evidence justified conviction of homicide by arsenic poisoning and affirmed the judgment of the lower court.

This is a very unusual case of poisoning by arsenic which apparently left no evidence of the presence of arsenic by chemical analysis. It seems to me impossible that traces of arsenic could not have been detected in the long bones, the hair or in the nails of the dead person. The case, however, is of interest as a conviction was obtained without finding the poison.

#### *Blood transfusion for carbon monoxide poisoning*

When carbon monoxide combines with oxyhæmoglobin a dangerous compound—carboxyhæmoglobin—forms. This is dangerous because it causes anoxemia. Hæmoglobin is the normal oxygen carrier whereas carboxyhæmoglobin is not.

When the blood of a donor is introduced into the vein of a victim this new transfused blood will act

immediately as an oxygen vehicle. The essential point to remember in these poisoning cases is that the transfusion must be preceded by venesection. The object of the preliminary venesection is to cause a pilgrimage of new red blood cells from their normal habitat and point of genesis in the bone marrow into the general circulation. It is therefore safe to conclude that venesection followed by blood transfusion in cases of very severe carbon monoxide poisoning may be an effective emergency measure and prevent death. (K. C. Koch, *Munch. Med. Wochenschr.*)

The transfusing of blood for hæmorrhage and shock amongst air raid casualties and severely wounded in the field is now routine treatment as far as circumstances permit. Owing to the difficulties of storing blood, work is now being carried out on dried blood plasma as a more economical and easy substitute for blood. The time may not be far off when tubes containing dried blood plasma crystals enough for a dose will be made available for all.

#### *Illicium religiosum*

The *Illicium religiosum*, sometimes called the bastard anisi, is a Japanese plant known as the *Skimmi* of Japan, the Japanese sacred anisi tree. Its fruit in India is called *Badyan khatai*, and is favoured as an adulterant of the true star-anisi fruit. The fruit of star-anisi, which is chiefly used in the manufacture of oil of anisi, consists of eight boat-shaped foliicles or carpels arranged around a central axis. The carpels have an acute summit and taper to a nearly straight beak; externally they are reddish-brown and somewhat wrinkled, the inner surface is smooth and shining and encloses a single, smooth, compressed ovoid brown seed. The odour and taste is aromatic resembling anisi, and serve to distinguish them from the fruits of the Japanese star-anisi. It is not possible to differentiate between them by naked-eye appearances. Both have eight carpels. The fruit of the true star-anisi is extensively used in local medicine as a carminative and stomachic. The fruit of the Japanese variety on the other hand is very poisonous and when taken internally causes vomiting, epileptiform convulsions with dilated pupils, cyanosis and death. The poison present belongs to the group of convulsants of the pierotoxin type.

A fatal case of poisoning with this fruit was received from Jullundur and concerned a Hindu male, aged 22 years, who was given a medicine for his dyspepsia. The seeds were boiled and ingested, and two hours after taking the medicine he exhibited the symptoms of vomiting followed by convulsions. On admission into the civil hospital he had toxic spasms of the whole body, recurring about every half an hour. His eyes were very congested and he could not speak. He died 24 hours after taking his medicine. The post-mortem signs were not very distinctive, there was congestion of the brain and spinal cord and both lungs showed congestion, the heart was full of thick black blood, suggesting death to be due to asphyxia. The viscera and solid organs of the abdomen were practically normal.

The poison was detected in the stomach contents, and the intestine by means of the microscope, the husks of the seed closely resembling those of the dhatura seeds, but in addition there were very typical honey-combed cells. This examination was carried out, side by side, with the genuine poisonous fruit of the *Illicium religiosum* as a control. No definite active principle of the fruit could be isolated by chemical means.

The poison suggested by the civil surgeon was strychnine and the symptoms all resembled strychnine except that there was unconsciousness in this case.

#### *Yellow oleander poisoning*

A Hindu male aged 32 years was admitted into the Mayo Hospital in an unconscious condition and died in 25 minutes. Four hours previous to his death he was seen riding a bicycle. The police information was that he had died as a result of drinking 'Butti'—a native medicine. On admission, all the muscles of the body were in a spastic condition and the patient was getting frequent violent spasms. Dr. Quick, who saw him first,

states 'that there was some cyanosis of the lips and nails. The muscles including those of the interior and lateral abdominal walls felt almost as hard as a wooden board and his fingers were clenched'. The vessels of the brain were congested, the lungs were markedly congested, the right heart was distended whilst the other chambers were contracted, the alimentary canal and the solid organs showed venous congestion. Death appeared to be due to a cardiac poison. The poison suspected was strychnine.

On analysis, the active principle of the yellow oleander (*Thevetin*) was detected in all the viscera. This kind of poisoning is quite common in South India but such cases are rare in this part of India.

It is remarkable, however, that with poisoning by *Illicium religiosum* and yellow oleander, the symptoms observed led both the civil surgeons to suspect strychnine poisoning, death from which is described in textbooks as being sufficiently characteristic to be diagnosed from the symptoms alone.

## Medical News

### THE FIRST ANNUAL GENERAL MEETING OF THE PHARMACEUTICAL AND ALLIED MANUFACTURERS' AND DISTRIBUTORS' ASSOCIATION LIMITED, HELD ON WEDNESDAY, THE 30TH APRIL, 1941, IN BOMBAY

THE President, E. W. Fairbrass, F.C.S., M.P.S., submitted his address:—

'Gentlemen,—It is my pleasure this morning to address you at the First Annual General Meeting of our Association, and it is with feelings of great pleasure that I note so many have attended to-day.

The period under review is rather less than one year; nevertheless it has been a period full of hard work. You have all had the preliminary report in your hands and an opportunity to read the brief history which gives you some idea of what happened before the Association was formed, and how it became an accomplished fact. The Central Government has been pleased to place us on their list of approved associations, i.e., recognized bodies such as the Chambers of Commerce and Trade Associations in this country.

It is not necessary for me to speak at any length on the work that has been done by the Association during the period under review. You have all been furnished with the minutes of the meetings held by the managing committee and the comprehensive information given in those minutes is ample evidence of some of the work that has been done.

We may not all be satisfied with the general outcome of the endeavours that have been made to obtain what we wanted or what we thought was best for us, but there is no doubt the Association has been instrumental in keeping certain bodies alive to the fact that we, as an Association, are doing our utmost to carry out the objects for which we were formed.

In these days of war, we are all having an extremely difficult time in carrying on in business. 'Business as usual' sounds more and more ridiculous. At every step one takes these days one finds how impossible it is to adhere to it! The mere cost of staying in business, not to speak of doing business, continues on the up grade. Some of our members who were representing continental manufacturers have lost not only a large volume of business but considerable incomes. Some of them have been enterprising enough to start manufacturing in this country, and it is to be hoped that they will be successful, and that they will be able to dig their toes in deep enough to establish firmly what they have started and in due time realize their aims in having consolidated manufacturing concerns in this country.

This brings me to the subject of import trade control, and although it is difficult for some of us quite to see reasons for control, we must believe there are very sound reasons for introducing these restrictions to conserve currency. For one thing, it is an ideal method of absorbing some of the unemployed, since more and more people are needed for doing the additional work imposed by the Government regulations.

It is gratifying that there are no embargoes on the importation of our raw materials as yet. So long as we

can obtain raw materials, manufacturing in this country can be carried on, and it is pleasing to a good many of us that our principals abroad in Great Britain and America are not only seriously considering, but are even taking action in having a certain amount of manufacture done in this country.

This position is not appreciated to the extent that it might be. There is still a large proportion of the population in India who are being misled by unfair trading competition by certain manufacturers who, to say the least, are unethical in their methods of marketing merchandise in this country. It is common knowledge to a great many of us that there are no raw materials of certain types to be found in India, also that this country is not yet equipped with the necessary plant to carry on certain manufacturing processes, yet there are some manufacturers in this country who try to impress upon the medical profession and the general public that certain preparations are the produce of this country, and yet we know that they are imported from abroad in bulk and re-packed here. We also know that a number of these concerns are now endeavouring to build up their business with these re-packed materials and are definitely marketing them as substitutes for well-known foreign products. Business houses of repute in Great Britain, America and the Continent of Europe have spent lacs of rupees in this country establishing markets for their merchandise and we regret to see that several concerns in this country are trying to market their products on the goodwill of many of our principals. I am sure that none of us are afraid of good, sound, healthy competition—in fact, competition of the right kind is to be encouraged. It is a great pity, therefore, that this particular kind of unfair competition should be permitted in any way.

Many of our members have lost a considerable percentage of their staff by conscription to national service. The loss of executive and technical personnel can only be appreciated by those of you who are now trying to carry on in these difficult days with a depleted staff. It does sometimes appear that our job, which is very important, is not considered so to the extent that it might be. Why? This is probably due in some measure to the comparatively peaceful situation in which we find ourselves, so far from the actual centres where war is being waged. I do feel that at times far too many people do not seem to appreciate the fact that there is a war on and that it is extremely difficult to conduct our business in these troublesome days.

Legislation of various types gives us a tremendous amount of extra work and I am sure the Association has been instrumental in trying to solve a number of the problems such legislation brings about.

**Price control.**—Now just a few words about price control. I think that it is time some serious steps were taken to bring about an efficient system of controlling prices in Bombay. The honorary secretary of this Association and I had a very long interview with the controller of prices in Bombay and made various suggestions, but so far we have heard nothing. We also put up a suggestion to the surgeon-general with the Government of Bombay that a committee be formed to go thoroughly into this very important question. I



believe the surgeon-general was good enough to support this suggestion of ours and recommended it to the Government of Bombay; as far as I know, nothing further has been done in this connection up to the present time. We all know that it is possible, in certain areas, to buy practically any type of medicine that one may want, *provided* one is prepared to pay the price that is demanded. Our job these days has been made doubly difficult by those merchants who will persist in hoarding merchandise with the hope of getting colossal prices at some later date. We have to resort to cutting down orders, restricting supplies owing to the fact that we ourselves are experiencing great difficulty in obtaining replenishments of stock, and yet these merchants are permitted to continue doing business in this manner without any price control restrictions imposed on them. I feel that it is high time the Government of Bombay took a serious view of this situation and considered introducing some form of legislation which would solve this very important problem which now faces all our members.

Unfortunately we lost two members during the year but our numbers show an increase at the moment. Even with the enlistment of new members, there are still quite a number of reputable companies in this country whom we feel should be members and I would ask those of you who get the opportunity of doing a little recruiting in the interests of the Association, to do so.

It has been a very busy year; a lot of work has been done and although the future is rather obscure at the present time, I am sure that, if we cling together, a very sound future for the Association is assured.

My personal thanks are due to the honorary secretary who has put in so much time in the interests of the Association. You have only to glance over the minutes which have been sent to you regularly to see the tremendous amount of work he has done not only in connection with correspondence and meetings, but in undertaking interviews with various Government officers and other authorities. I would ask all members if they will, to continue in the future to appreciate this work and to try and make his job as easy as possible.

#### EXTRACTS FROM THE MINUTES OF THE MEETING OF THE UNITED PROVINCES MEDICAL COUNCIL HELD IN THE COMMITTEE ROOM OF THE OFFICE OF THE INSPECTOR-GENERAL OF CIVIL HOSPITALS, UNITED PROVINCES, AT LUCKNOW, ON SATURDAY, 29TH MARCH, 1941

The following resolution, the consideration of which was postponed to this meeting:

'This Council recommends to the Government of India that the Indian Medical Council Act, 1933, be amended on the following lines:

'to provide for a majority of elected members on the Council'

was lost.

The consideration of letter no. 4659-G, dated the 7th March, 1941, from the Inspector-General of Civil Hospitals, United Provinces, forwarding a letter from the Medical Council of India, suggesting that necessary steps, by enactment or otherwise, be taken to ensure that qualifications granted by institutions outside British India which are included in Schedule II to the Indian Medical Council Act alone are recognized by the Provincial Medical Council, was postponed to the next meeting. In the meantime, other medical councils be addressed to find out what they were doing about this. Also the legal position be ascertained.

The Council was in agreement with the proposal of the All-India Compounders' Association (*viz.*, that it should be made obligatory on registered medical practitioners to employ only qualified dispensers and dressers) and it was resolved that it should be enforced when we are in a position to do so. In the meantime

Government be requested to provide facilities for the proper training of compounders. A copy of this decision be forwarded to the Compounders' Association.

The case against Dr. Prayag Narayan Misra, L.S.M.F. (Reg. no. 2815), of Benares was considered and the Council judged him guilty of infamous conduct in a professional respect and decided that his name may be erased from the medical register. Further, it was decided that he may be permitted to apply for restoration (with certificates which are necessary for restoration) after a period of one year.

The case against Dr. Ganesh Ram Mullick, M.B., B.S. (Reg. no. 2717), of Benares was considered and the Council judged him guilty of infamous conduct in a professional respect and decided that his name may be erased from the medical register. Further, it was decided that he may be permitted to apply for restoration (with certificates which are necessary for restoration) after a period of one year.

The report of the Standing Committee, which met on 11th and 12th January, 1941, in connection with (1) amendments to the report of the Local Self-Government Committee proposed by the President of the District Board Medical Officers' Association, (2) Rai Bahadur Captain K. N. Goyal's certificate to a firm, which has been published in a newspaper, and (3) the proposal that prosecutions under the Indian Medical Degrees Act be published in the newspapers, was considered and their recommendations were accepted.

The report of the Standing Committee, which met on 10th March, 1941, regarding the advertisement by Dr. P. L. Whig, M.B., M.R.C.P., D.P.H., etc., an applicant for registration, was accepted.

The consideration of the amendments to the United Provinces Medical Act, and the rules thereunder, formulated by the Standing Committee and as finally approved by it at its meeting held on 10th March, 1941, was postponed to the next meeting and this subject to be the first item of the agenda.

#### NEED FOR REORGANIZATION OF MILK TRADE

REORGANIZATION of milk marketing and the creation of a 'monopoly' marketing organization, to be responsible for the purchase of milk from rural areas, its transport, processing and distribution, and the control of quality from the stage of production to that of actual sales, is the most important recommendation of the Agricultural Marketing Adviser to the Government of India in his 'Report on the Marketing of Milk in India and Burma'.

'The deplorable state of affairs existing in the milk trade of the country', he says, 'has been realized by many in the past, and comparison has often been rightly made with the progress achieved elsewhere in the world. . . . As a result of various circumstances peculiar to India—economic, social and religious—it may not be possible to achieve here all that has been achieved in other countries within the same space of time, but matters could certainly be considerably improved if the problem were tackled on the right lines'.

#### IMPORTANCE OF MILK IN DIET

He stresses the vital importance of milk to the Indian population, whose diet is deficient in first-class proteins which are easily obtained from milk. Both from the public health and the economic points of view—the annual value of India's milk production is estimated at over Rs. 175 crores—the dairy industry is of considerable importance.

Urging the need for complete control over the distribution of milk in an urban area, and thereby on the production of milk in the rural area concerned, the report says special legislation, of a provincial nature, will be necessary as, 'although there is an element of compulsion in the suggested monopolizing of the milk business, this appears to be the only way in which both producers and consumers can be protected'.

## STRICTER CONTROL OVER QUALITY

The report also urges the necessity for the revision of standards of purity and for more vigilant control of the quality of milk. 'Most milk', it states, 'is distributed under filthy conditions—enough to create a dislike for milk in the minds of many consumers. . . . There is a strong feeling amongst consumers and progressive milk dealers that official control of the quality of market milk has been very lax. Adulterated dirty milk is gradually driving away pure and clean milk from the market. It is almost impossible to obtain pure milk in open markets, with any degree of certainty'.

The abolition of 'mixed' milk standards, which allow scope for adulteration; the rising of the standards for 'cow' and 'buffalo' milk to correspond with the natural composition of Indian milk; the recognition of toned 'Standard' milk and the re-drafting of by-laws relating to the production and sale of milk and dairy products, so that they can be properly enforced, are recommended.

## ORGANIZATION OF COLLECTORS

The application of co-operative principles to the assembling and distribution of milk not having produced the desired results, the report recommends that efforts should be made to organize the collectors of village milk who handle large quantities, and not only the producers, as has been done so far.

'To improve the fluid milk trade', it is urged, 'the small and inefficient processor and distributor must be gradually eliminated. Processing and distribution in cities and towns must be entrusted to large, well-managed organizations, which can make use of every aid that science can offer and can improve the technical efficiency of their business and put on the market a high quality product.'

The cost of handling 1,000 maunds of milk a day under the proposed scheme of reorganization would necessitate the investment of approximately Rs. 4,50,000. As the scheme is a self-supporting one, the sum is likely to be recovered in less than ten years.

## Current Topics

## Low Back Pain

By P. C. WILLIAMS, M.D.

(Abstracted from the *Southern Medical Journal*, Vol. XXXIII, August 1940, p. 788)

THE knowledge which has been gained during the past fifteen years regarding the condition spoken of as low back pain, lumbago and sciatica if properly correlated should practically eliminate the confusion which has been associated with these conditions. The literature of the past decade has presented many theories which to those who do not specialize on this ailment may appear to be severely contradictory. It is the opinion of the author that this is not the case and that most investigators are rapidly progressing to a common conclusion.

It has been definitely shown that the lower lumbar and lumbosacral articulations are responsible for symptoms in the majority of those cases suffering with the complaints already mentioned. Attributing such symptoms primarily to infection, muscle strain or mechanical disorders of the female pelvis is far less prevalent than it was a few years ago when a pain in the lower part of the back was too often taken as an indication for an investigation of practically all parts of the body except the spine.

Changes within the lumbosacral and less frequently other lumbar intervertebral disks are undoubtedly the cause of symptoms in more than 90 per cent of those patients who present themselves with any one or all of these complaints. Trauma is the etiologic factor in bringing about the changes within the disk in most cases. The various mechanical factors, which result in degenerative changes of the annulus fibrosus and in turn the nucleus pulposus, will be designated.

## ACUTE TRAUMATIC DESTRUCTION OF THE INTERVERTEBRAL DISK

An acute traumatic rupture of the disk usually occurs between the ages of 10 and 25 years and is the result of a definite injury, the mechanics of which are compressive in character. In childhood and early adult life the nucleus pulposus of the lumbosacral disk is a definite fluid-like structure capable of resiliency and intervertebral support, therefore subject to rupture. Symptoms following the acute injury are often severe, but as a rule temporary in character. Later, varying from a few weeks to several years, usually while lifting a load, the patient again suffers an attack of pain in the lower part of the back. Such attacks may occur repeatedly and eventually are associated with an accompanying pain radiating down one and occasionally both extremities to the lateral aspect of the calf and ankle, following the fifth lumbar nerve distribution.

The most constant history associated with severe recurrent attacks of pain is that of some motion which involves hyperextension of the lumbosacral spine combined with a contraction of the erector spinae muscles.

Many acute ruptures would have been avoided had the compressive force been evenly distributed on the intervertebral disk, but in the presence of a static disturbance in the mechanics, the compressive force is applied primarily to one portion of the annulus fibrosus which ruptures under the strain. For this reason many disks which would eventually have given way to a chronic uneven distribution of weight are ruptured at an earlier period in life.

## CHRONIC DESTRUCTION OF THE INTERVERTEBRAL DISK

Providing an individual, who presents a mechanical alteration and thus an uneven distribution of weight on the lumbosacral disk, does not suffer an acute injury, symptoms usually do not make their appearance until some time during the fourth decade of life. Such a patient may enter around the age of 35 giving a history of an acute sudden onset of pain following an injury. X-rays will show findings characteristic of a destruction of the disk, but associated changes give evidence that the process has been going on through the years, and for this reason the injury must be considered as only the factor which initiated clinical symptoms.

The commonest cause of an uneven distribution of weight on the intervertebral disk is a lordosis of the lumbosacral spine. Due to the erect posture of man which transmits the weight of the trunk to the posterior fibres of the annulus fibrosus of the lumbosacral disk, degenerative changes caused by stress have opened avenues of escape for the nuclear content and a fibrous degeneration has taken place by the time the individual has reached the age of 40. For this reason most individuals at this age period are potentially subject to pain in the lower part of the back. The stress on the posterior fibres of the lumbosacral disk is in proportion to the acuteness of the lumbosacral angle. Severe acuteness in the individual of the constitutional type who is short of stature, well nourished and presents firmly constructed joints and a good muscle tonus is due frequently to tight muscles and fascias in the anterior and lateral aspects of the thighs. The latter prevent an elevation of the front of the pelvis. In individuals of the constitutional type who are tall, thin and present long extremities and loose joints and exaggerated lumbosacral angle appears to be due to a poor muscular tonus which causes them to assume a relaxed attitude in a position of balance while in the erect posture.

A lateral tilt of the first sacral vertebra due to a short leg or a developmental disturbance within the sacrum itself is the common cause of increased pressure on the lateral aspect of the lumbosacral disk. In maintaining the centre of gravity over the base of support it is necessary to distribute the greater part of the weight of the trunk to that side of the intervertebral disk which corresponds to the high side of the sacrum. Barring an acute rupture of the disk as a result of a compressive injury in earlier life, these patients usually present first symptoms between the ages of 25 and 35 years. The x-rays show findings characteristic of a traumatic destruction of the lumbosacral intervertebral disk.

The anomaly commonly spoken of as sacralization of the fifth lumbar vertebra is another cause of an uneven distribution of weight on the lower lumbar intervertebral disks. The fixation of this segment to the sacrum may be either unilateral or bilateral. When bilateral, the lumbosacral intervertebral disk retains a normal structure throughout life, but the articulation between the fourth and fifth vertebrae must compensate severely for the erect position, and in so doing the intervertebral disk at this site receives a severe stress on its posterior portion. If not ruptured acutely in early life, chronic trauma brings about degenerative changes of the disk and clinical symptoms usually by the age of 30. Aside from localized symptoms, pain and frequently nerve changes follow primarily the distribution of the fourth lumbar nerve on either side and sometimes both.

When the fifth lumbar vertebra is attached to the sacrum on one side only, in addition to the stress applied to the posterior portion of the fourth lumbar intervertebral disk, there is an abnormal stress taken on the free side of the lumbosacral intervertebral disk. Symptoms resulting from a settling of the free side of the fifth lumbar vertebra usually do not appear until after the age of 40. Segmental symptoms in such a case follow the distribution of the fifth lumbar nerve on the side opposite the fixation; however, for the reason already given this symptom may be combined with fourth lumbar nerve pain on either side.

The anomaly spoken of as lumbarization of the first sacral segment is also capable of disturbing the weight-bearing mechanics at the lumbosacral articulation and thus causing an uneven distribution of weight on the intervertebral disk at this site. This condition may also be unilateral or bilateral. Whether unilateral or bilateral, the posterior fibres of the annulus fibrosus of the lumbosacral disk receive an abnormal stress from an uneven distribution of weight caused by an abnormally acute lumbosacral angle which these cases present. Unless ruptured early by an acute injury degenerative changes have caused a settling of the disk, and clinical symptoms usually appear by the age of 35. Aside from localized pain, symptoms follow primarily the distribution of the fifth lumbar nerve on either side and sometimes both. When the intervertebral disk between the first and second sacral segments is well developed and the segment is entirely free on one side, abnormal stress on the free side may cause a gradual settling, resulting in clinical symptoms following the distribution of the first sacral nerve on the free side. This particular symptom usually does not occur until after the age of 45, but earlier symptoms following the distribution of the fifth lumbar nerve may have been present at an earlier date for the reason already given.

An infectious destruction of the lumbosacral intervertebral disk is occasionally seen and in early cases may be mistaken for the ordinary case which enters complaining of pain in the lower part of the back; however, the clinical course will usually differentiate it from the latter. The author has seen two cases of tuberculous destruction of the lumbosacral intervertebral disk which were treated for sciatica because of the segmental pain throughout the distribution of the fifth lumbar nerve, before the true nature of the lesion was recognized. Aside from tuberculosis the

other commonest infectious destruction of the lumbosacral and other intervertebral disks is caused by the typhoid bacillus. The acuteness of pain and the inflammatory symptoms will readily differentiate the latter from the ordinary case.

Spondylolisthesis, while not a primary disk lesion, occurs to the extent of approximately 4 per cent and therefore should always be considered in those presenting themselves complaining of pain in the lower part of the back. In the author's experience segmental symptoms have not been a common finding in these cases. Pain in the lower part of the back radiating through to the abdomen, the anterior upper thigh and the groin is a more common complaint.

Fragmentation of the facets at the lumbosacral articulation constitutes less than 1 per cent of the patients entering with the complaint already outlined. When present, symptoms usually follow the distribution of the fifth lumbar nerve on the affected side.

*X-ray changes.*—It is the author's opinion that the recent inclination to insert an opaque oil into the neural canal in an effort to determine disk changes has been severely abused. A ruptured intervertebral disk at the lumbosacral or lower lumbar articulations can be interpreted by facet changes providing a proper x-ray technique is employed. Repeated careful clinical examinations will afford adequate information to determine whether the prolapse of the disk itself is sufficient to be of clinical significance. When the supportive structure of the nucleus pulposus is lost there is an immediate settling of the vertebra above, which is always registered on the corresponding facets when stress is being applied. Therefore either weight-bearing or in reclining, an extended position of the low spine is essential in obtaining proper facet relationship. All studies taken for the purpose of facet readings should be stereoscopic. Best results are obtained by a rotating anode tube. The patient should be posed in such a position that superimposed bony structures are minimal.

Narrowing of the intervertebral joint space is not so important in an interpretation of x-ray studies as are the facet articulations. This is due to the fact that a settling of the disk is frequently stopped by contact of bony structures. Therefore, primary attention should be focused on the articular facets in an effort to determine whether there is an overriding of these processes. Frequently the first sacral facets lodge in the inferior vertebral notches before an appreciable narrowing of the disk is apparent. Under such conditions they become weight-bearing structures and produce a scarring of the vertebral notches of the fifth lumbar vertebra as well as a sclerosis of the superior margins of the first sacral facets themselves. In the anteroposterior study, this sclerotic change presents an irregular line at the junction of the lamina and the inferior articular facet of the fifth lumbar vertebra which may be misinterpreted as a fracture. In addition, the bony irritation in the inferior vertebral notch may result in a spur formation.

When settling of the segment above is stopped by lodging of the superior facets of the segment below the inferior facets of the above segments frequently appear atrophic when viewed by x-ray studies. This is due to the fact that the superior facets of the lower segment become weight-bearing structures and have taken over the load, thus moving the stress from the inferior facets of the above segment.

The degree of narrowing of the lumbosacral space depends primarily on the acuteness of the lumbosacral angle and the magnitude of the first sacral facets. When the lumbosacral angle is acute and the superior first sacral facets are large, the latter will lodge in the inferior vertebral notches before the narrowing of the disk has become greatly apparent or in extreme cases even before the narrowing has become appreciable.

Occasionally the spinous processes, when large, contact each other and prevent further settling of the disk.

Marginal lipping around the inferior and superior borders of the vertebral bodies adjoining the affected disk is the result of abnormal stress on bony structures

which has resulted from a loss of the resilient intervertebral disk.

#### THE CAUSE OF SYMPTOMS

It is the opinion of many investigators to-day that disk changes account for symptoms in most of the cases frequently referred to as sciatica and lumbago. There is yet considerable confusion as to what change results in the segmental symptoms which these patients present. It is the author's opinion that they are due primarily to resultant disturbances in the mechanics in the lower part of the spine and that to ignore these and remove a prolapsed disk will result in persistent local and segmental symptoms following such surgical procedures.

The lumbosacral intervertebral disk undoubtedly suffers more from trauma than any other disk within the spine. The reasons for this are too apparent to be enumerated in this paper. A careful study of the anatomy of this region will reveal that the prolapse of the annulus fibrosus or the nucleus will not contact the fifth nerve root, yet none can deny that most cases present segmental symptoms throughout the distribution of this segment. The nerve emerges from the canal just below the inferior vertebral notch and contacts only the lateral aspect of the lumbosacral disk.

We should bear in mind that below the cord we are dealing with a bundle of nerve segments bathed in spinal fluid and confined in an area of the spinal canal which has been enlarged by nature to accommodate mobility at this site. Because of this, slight displacement from within would not be expected to cause symptoms so severe as at a higher level. If the magnitude of the protruding disk is great enough, an irritation of the meninges would be expected. This should cause a wider-spread distribution of symptoms than most of the cases present when once they become chronic. It is probable that the extensive distribution of pain occasionally seen in those patients who have suffered their original injury is due to such an irritation; however, symptoms usually subside in these cases and the fixed segmental pain follows months or years later. The funicular portion of the nerve should be more subject to irritation than the intraspinal portion since it is not protected by spinal fluid. It is more logical to conclude that such symptoms are due to progressive changes which follow the rupture of the disk. When once the nucleus ruptures the annulus fibrosus undergoes an atrophic degeneration which results in a gradual narrowing of the intervertebral space providing stress is continued and not interfered with by the contact of certain bony structures. From anatomical studies it becomes apparent that as the disk settles there results a subluxation of the lumbosacral facets and that the first sacral facets may directly contact the funicular portion of the nerve as it emerges through the lumbosacral foramen. With such a mechanical situation hyperextensive motions of the low spine may result in an impingement of the nerve root. A careful study of the histories of these patients will reveal that recurrent attacks accompany a contraction of the erector spinae muscles at a time when the lumbosacral spine is in an extended position. Examples are lifting a load above the waist line, pivoting on a golf drive and raising a window.

In two patients who presented severe fifth lumbar segmental symptoms, a fusion was accomplished without relief of symptoms. A second operation consisting only of a removal of the lumbosacral facets on the side affected afforded complete relief.

Over a period of eight years the facets have been removed and a graft placed in thirty-two patients. All, save one who died post-operatively, obtained relief of segmental symptoms.

It is the author's opinion that in better than 95 per cent of the cases, pain is due to mechanical alterations which have resulted in a constriction of the foramina and an impingement of the nerve root rather than to the prolapse of the disk itself. During the past year there have been two cases in which symptoms were

such that they indicated pressure within the canal. Both were referred to a neural surgeon, who did a laminectomy. One revealed a nucleus pulposus which had become completely separated from the intervertebral disk and was lodged in the foramen around the nerve root. A fusion was done at the time and a relief of symptoms has resulted. The other prevented a chondroma of the disk protruding posteriorly. It was removed and mechanics otherwise ignored. The patient, although considerably improved, continues to have segmental pain. Both cases presented a clinical picture which, when observed over a period of time, could not be confused with the usual case. Another patient under observation for the past year who was operated on elsewhere eighteen months ago, the operation consisting only of a removal of the prolapsed disk, continues to present pain and nerve changes throughout the distribution of the fifth lumbar nerve.

#### TREATMENT

All cases should be given a prolonged conservative treatment before any radical measures are considered. With a thorough conservative programme, better than 90 per cent of the cases will be relieved to the extent that they are happy to continue without surgery. This depends to a considerable extent on the occupation of the patient. Where heavy lifting is necessary it is difficult to control the mechanics of the lower spine. Conservative methods are based on reducing the lumbosacral angle and thereby lifting the weight from the posterior structures at this site. This means that the lordosis of the lower spine must be reduced to a minimum at all times, thus flexion of the hips is preferable when reclining. A slightly slumped position is desirable in sitting and in standing a straight lumbar spine is indicated. Lifting should be done without extending the low back and patients with such a lesion should always avoid bending backward. Spinal surgery should never be employed until a thorough conservative programme has overcome a fixed lumbosacral lordosis and lengthened short fascias and muscles of the anterior and lateral aspect of the thigh. The latter may require severing as described by Ober. If this is not done, pain just above the graft or at the lumbosacral joints due to a downward pull on the front of the pelvis may either persist or make its appearance following surgery of the lumbosacral spine.

One should have a thorough understanding of segmental symptoms before spinal surgery is attempted. Such surgery should consist of relieving nerve root irritation by removing the facets which correspond to the segmental distribution of pain and nerve changes and at the same time laying a lumbosacral graft. In those few cases presenting symptoms more suggestive of a spinal cord tumour due to fixed pain and nerve changes as well as spinal fluid changes, there is an indication for an opaque oil in the neural canal in order to gain a better understanding of the pathological change before surgery is undertaken. When such surgery is indicated the mechanics of the low spine should not be overlooked. A graft should be placed and facetectomy usually performed if we are to avoid post-operative symptoms.

#### Pyelitis

By T. H. OLIVER, M.D., F.R.C.P.

(From the *Practitioner*, Vol. CXLV, July 1940, p. 1)

PYELITIS, or inflammation of the pelvis of the kidney, presents difficulties to the clinician in two ways. In the first place, the symptoms may simulate those of other conditions, diagnosis may be difficult, and the favourable opportunity of early treatment may be lost. Secondly, even if the correct diagnosis has been made, some condition underlying and predisposing to it may be overlooked and the chance of permanent cure diminished. These cases therefore may require a most careful and systematic investigation and certain points

in the aetiology of the condition should be borne in mind:—

(a) It is much more common in women than in men; of my own cases 84 per cent were women.

(b) More than 75 per cent of cases are due to the *Bacillus coli*. Other organisms which may be responsible are the streptococcus, the proteus bacillus and the staphylococcus: this last being commonly associated with a calculus. Mixed infections, however, are not uncommon and, owing to the profuse growth of the *B. coli*, the presence of another organism may go undetected.

(c) It is usually a blood-stream infection but some determining factor may be present:—

(1) Previous damage to the kidney.

(2) An unhealthy condition of the gastro-intestinal tract.

(3) A manifestation of a lack of resistance owing to the presence of some chronic disease.

(4) An ascending infection from a cystitis—although this is not yet absolutely proved.

Clinically the disease is divided into acute and chronic, but it should be remembered that a chronic case may develop acute symptoms which may be the first manifestation of a condition previously unsuspected. The careful elucidation of apparently trivial symptoms—a slight dysuria or frequency, the occasional passage of offensive urine or mild febrile attacks, which have been regarded as influenza—may indicate an unhealthy urinary tract as the origin of a vague ill-health which may have been in existence for years and which in many cases may be traced back to a previous pregnancy. Of all the aetiological factors pregnancy is probably the commonest, and occasionally an attack of pyelitis is the first indication of the condition.

In acute pyelitis there may be a prodromal period of a few days during which the patient may complain of increased frequency of micturition and general malaise: usually, however, the symptoms are not sufficiently severe to warrant confinement to bed or even to the house, and the temperature is little, if at all, raised. The acute phase begins suddenly, often with a rigor, which in a severe case may be repeated, and the temperature may remain high for a week or more. Urinary symptoms are usually present and may be severe, and there is a marked increase in frequency with a scalding pain on micturition. The urine itself has an opalescent appearance and in *B. coli* infections is intensely acid and has an unpleasant fishy odour. Hæmaturia may occur, but it is uncommon for it to be excessive and in many cases it is entirely absent. A moderate degree of albuminuria is common.

#### DIAGNOSIS

The differential diagnosis may be difficult. In some cases pain in the flank or severe generalized abdominal pain with distension may occur at the onset, and the case may easily be mistaken for one of acute appendicitis. Rigors, especially if recurrent, and the higher temperature in pyelitis together with tenderness in the loin rather than over McBurney's point, with increased frequency of micturition, will in most cases enable the distinction to be made. It should be remembered, however, that appendicitis may be a predisposing cause of pyelitis and the two conditions may coexist. A retrocæcal appendicitis, in particular, may give rise to especial difficulty, and a diagnosis may be impossible until a microscopical examination of the urine has been made. Occasionally the urinary symptoms are not pronounced, there may be no localized tenderness and the continuous temperature may lead to suspicion of a typhoid infection. As sweating in pyelitis is often a prominent symptom, its presence may appear to indicate the existence of abortus fever. Probably, however, abdominal influenza is the mis-diagnosis most commonly made.

In children, headache, delirium, and vomiting may be so severe as to arouse suspicion of meningitis. Occasionally in adults cerebral symptoms are pronounced. In one case of a woman of thirty, the head retraction was so marked that a diagnosis of cerebro-spinal meningitis was made and was only disproved by

the finding of a normal cerebro-spinal fluid. In a few cases renal colic is the predominant symptom, although the presence of a stone cannot be demonstrated by x-ray. The final establishment of the diagnosis can only be made by a bacteriological examination of the urine. As in many instances the urinary symptoms are slight, pyelitis should always be borne in mind in cases in which there is an unaccountable rise of temperature, and a catheter specimen of the urine should be sent for microscopical and bacteriological examinations. Cystoscopy is not necessary in the acute phase, and is indeed highly inadvisable.

*Course.*—The acute phase lasts for a week to ten days, but the actual duration will depend on early diagnosis and on the efficacy of the treatment adopted. If treatment is begun early and pursued vigorously, the fever subsides in a week and the patient's general condition improves. In most cases three to six weeks' treatment is required before the urine becomes sterile, and when this has been achieved a recurrence is unlikely. The dangers are that with the subsidence of symptoms the patient may get up and abandon systematic treatment before the urine has become sterile, or a concealed focus of infection may be overlooked. As a general rule a minimum of three weeks in bed should be insisted upon.

#### TREATMENT

*The acute phase.*—Confinement to bed and ample fluids are imperative. Fruit juices in themselves tend to make the urine alkaline and the patient should be encouraged to take them freely. With the subsidence of the temperature and an improvement in the appetite, toast, rusks, or other carbohydrates may be given. I prefer not to give milk in the early stages and alcohol should always be avoided. Sweating is often a marked feature, and on this account the patient should be nursed between blankets in the early stages. The bowels should be opened by means of soap-and-water enemas. The use of purgatives is of doubtful value. Powerful intestinal irritants may do more harm than good, and I use a mild aperient—infusion of senna or one of the proprietary brands of cascara—only if the result of the enema is unsatisfactory. While the temperature is high, potassium citrate 30 grains, at three- or even two-hourly intervals until the urine becomes alkaline, is still a satisfactory form of treatment, and in many cases the urine becomes sterile with this alone. Since the introduction of the sulphonamide group of drugs, I give them in addition, in doses of 1 gm. four-hourly, and there seems to be no doubt that they enhance the chances of a complete recovery. These drugs have the advantage over mandelic acid in that they are active in an alkaline urine, and there is therefore no necessity to omit the potassium citrate. As in most cases their action is somewhat depressing, I prefer to use them only after the acute phase is subsiding and some clinical recovery has begun to take place. After the acute attacks have subsided iron is usually advisable to combat the anæmia which is almost always present to a greater or lesser extent.

#### CHRONIC PYELITIS

Chronic pyelitis is a common cause of vague ill-health and may continue unsuspected for many years, unless the possibility of its presence is borne in mind. For long periods there may be little or no rise of temperature and the symptoms may be attributed to debility, anæmia or neurasthenia. Headache, backache and generalized rheumatic pains are common, and there may be periodical rises of temperature with slight shivering and malaise and general aching, which are diagnosed as influenza. When a patient gives a history of repeated attacks of 'influenza', particularly if they occur when that disease is not epidemic and if there is no history of other members of the household being affected, I always suspect that the cause of the trouble may be found in the urinary tract.

Sometimes a frank attack of pyelitis, with rigors and all the symptoms previously described, is the first indication of an infection which may have been in existence for many years.



I recently saw a woman who had had an attack of pyelitis during her first pregnancy and had only had another one fifteen years later. In the interval a tendency of polyuria, slight anemia and the occasional passage of offensive urine were the only indications that the disease had not been completely eradicated.

Although in many cases chronic pyelitis is the result of an acute attack, which has either been unrecognized or has been inadequately treated, it may come on insidiously without any obvious cause.

In a proportion of cases it is associated with disease of the urinary tract, a renal calculus or a hydronephrosis arising either from the compression of the ureter against the pelvic brim by an enlarged uterus or from a congenital abnormality of the ureter. Usually a growth of staphylococcus is an indication of a renal calculus, and recent evidence would appear to show that the organism may be the predisposing cause of the calculus formation, as cases have occurred in which staphylococci, with the same peculiarities as those cultivated from the urine, have been grown from the centre of the stone itself. Often a calculus is associated with a mixed infection of *B. coli* and staphylococci, and the latter may be overlooked owing to the profuse growth of the former.

The symptoms of calculus may be slight and its presence unsuspected until it had been revealed by x-ray. A radiological examination of the kidney should be made as a routine in all chronic cases, and a pyelogram may be required to show the presence of an unsuspected hydronephrosis, due perhaps to a congenital malformation of the ureter or to pressure on it by calcareous tuberculous glands. In men an enlarged prostate may be the cause of a cystitis and a subsequent pyelitis, which would appear to be due to an ascending infection. Occasionally renal tuberculosis may be complicated by a coexisting *B. coli* infection and the primary condition overlooked.

The next most common predisposing cause of pyelitis is an *unhealthy gastro-intestinal tract*—either an abnormality of function, diarrhoea or constipation, or definite organic disease. Diarrhoea would appear to be a commoner cause than constipation, and in the latter case it is probable that the chronic irritation of the intestinal mucous membrane by the purgatives taken to correct it, rather than the constipation itself, is responsible in a large number of instances. In my experience, indeed, constipation is rarely a cause of the condition unless it is due to some organic obstruction. Thus in one case, in which recurrent attacks of pyelitis had not cleared up despite systematic urinary disinfection, and in which constipation was a prominent feature, the removal of a small fibroid which had been pressing on the pelvic colon cleared up the condition completely.

In obscure cases the *gall-bladder* may be the infecting agent, and a Graham's test will be required. More commonly diverticulitis or a chronic appendicitis is the underlying cause and, if the latter is situated in the pelvis, it may be unrecognized for many years, as there may be little evidence of it on ordinary abdominal examination. A rectal examination should therefore never be omitted. A *malignant growth of the bowel* is also a not uncommon cause of pyelitis and may easily lead to errors. Twice in the last few years I have seen a case in which pyelitis was the first indication of anything seriously wrong, and in both cases it occurred before there had been any symptoms of obstruction. A full gastro-intestinal x-ray is therefore necessary in a persistent case: the possibility of uterine or ovarian disease should also be remembered and any abnormality of function investigated by a bimanual examination. Finally, pyelitis may complicate some constitutional disease. It is not uncommon in diabetes mellitus and will not yield to treatment until the diabetes has been got under control, or it may be associated with a chronic nephritis or a severe anemia.

#### COMPLICATIONS

Complications are uncommon. There may be an associated cystitis which usually clears up after treatment of the pyelitis. Occasionally a *B. coli* epididymitis

may be a painful complication and may lead to a suspicion of gonorrhoeal infection. More rarely, there may be a prostatitis or a urethritis. In neglected cases the presence of a considerable quantity of albumin and pus in the urine is evidence that the infection has invaded the kidney. Even then, with modern methods of treatment, the outlook is not hopeless.

In one case, that of a man of sixty, the urine was so foul and the general symptoms so severe that a nephrectomy was advised. The patient refused and his condition continued to deteriorate until the introduction of the ketogenic diet. To this he responded so well that eventually the urine became sterile and has so remained for several years.

#### TREATMENT OF CHRONIC PYELITIS

Before the introduction of the ketogenic diet and its derivative mandelic acid, the treatment of the chronic case was most unsatisfactory and patients were occasionally met with who had had the condition for twenty years or more. Vaccines and the drugs of the hexamine group were of some assistance, but in my experience rarely eliminated the disease. More recently the sulphonamide group of drugs has in many cases proved more effective. The ketogenic diet was introduced after the discovery that  $\beta$ -hydroxybutyric acid was lethal to the *B. coli*. It was most successful, but its unpleasantness has made it now of only historical interest and it has been replaced by mandelic acid or one of its compounds. This acid is a phenol derivative of  $\beta$ -hydroxybutyric acid, which can be taken by mouth, and is excreted as such in the urine, and has an effect similar to the acid itself. If the mandelic acid itself is used, it is essential that the urine should be acidified to pH 5.5 by giving ammonium chloride at the same time. The fluid intake is reduced to two pints daily in order to concentrate the urine, 12 gm. daily of the acid are given in divided doses (usually 45 grains), and eight 15-grain capsules of ammonium chloride are given in addition. The acidity is controlled by testing with a solution of methyl red. As many patients are nauseated by ammonium chloride, ammonium mandelate is now generally used, 50 grains four times daily being the usual dose required. Even then a few doses of ammonium chloride may be necessary to reach the required acidity. This treatment is effective, not only for the *B. coli*, but for the *Streptococcus faecalis* and to a lesser extent for *B. proteus*. A frequent practical difficulty is to reach the required acidity of the urine and to ensure a sufficient concentration of the drug. Nausea may prove troublesome in treatment, and occasionally there may be definite symptoms of toxæmia with severe urticarial rashes.

Recently the sulphonamide group of drugs has tended to replace mandelic acid. They are quite as powerful in their effect on the *B. coli* and in addition are more active against the *Streptococcus hæmolyticus* and the *B. proteus*. They have also the advantage that they are more active when the urine is alkaline and so can be given in conjunction with potassium citrate. In cases of *Streptococcus faecalis* infection mandelic acid is the more powerful, but apart from this I would consider the sulphonamide group as the method of choice; and it has the great advantage that even with a damaged kidney the drug is excreted in sufficient concentration to be effective. I usually give  $\frac{1}{2}$  gm. four-hourly for four to five days, which in many cases is sufficient to render the urine sterile. It is advisable, however, to repeat the course after a few days' interval, in order to make assurance doubly sure.

Toxic symptoms, apart from some cyanosis, are rarely severe, although in a few prostration or vomiting may compel discontinuance of the treatment and the substitution of mandelic acid. Sulphapyridine (M. & B. 693) is equally but, in my experience, no more effective than the earlier sulphonamide drugs and, as it is often very nauseating, I do not use it in this group of cases. Washing out of the bowel with normal saline may be



helpful, if there is evidence that it is the primary cause of the trouble, but in the majority of cases this is unnecessary.

When the treatment has ceased, the patient should be told to report periodically for the next twelve months and a catheter specimen of urine should be examined to eliminate the possibility of recurrence. If this has occurred, it is almost certain that a predisposing factor exists which has been overlooked.

### CONCLUSION

With careful diagnosis and thorough treatment the prospects of a successful outcome in pyelitis are great, and the practitioner has the satisfaction of achieving a success which would have been impossible less than twenty years ago. In the pyelitis of pregnancy the success of modern treatment has been particularly effective, and termination for this reason alone is now never necessary.

## Reviews

**STATISTICAL METHODS FOR MEDICAL AND BIOLOGICAL STUDENTS.**—By Gunnar Dahlberg, M.D., LL.D. 1940. George Allen and Unwin, Limited, London (Ruskin House, 40, Museum Street, W.C.1). Pp. 232. Illustrated. Price, 10s. 6d.

THE appearance of this book is opportune as there seems to be a growing desire on the part of medical research workers to base their conclusions on a statistical analysis of their experimental data. For the purpose of planning experiments and of drawing valid conclusions from them it is desirable that the medical worker should himself be familiar with statistical methods. This book should serve to fulfil this purpose to a large extent.

The book explains the applications of elementary statistical methods for analysing those types of data with which medical and biological workers have to deal. Although it is not free from mathematical symbols the author has struck a compromise between the mathematical demands of statistical science and the limitations of the average medical or biological student. The exposition is lucid. The examples illustrating the application of statistical methods are based on medical problems. However, certain statistical terms such as 'histogram' given on page 43, 'exponential equation' on page 48, 'standard error' and 'probability equation' on page 73, 'correlation' on page 94 and 'coefficient of correlation' on page 113 have been introduced at a stage when their meaning is not likely to be understood by the beginner.

In the first four chapters the author explains the conception of probability and the simple theorems of combination and permutation. With these simple concepts he proceeds to demonstrate how the proportion of dizygotic and monozygotic twins among twin pairs can be calculated and how the existence of certain hereditary characters among them can be studied. The remaining chapters deal with the different ways of analysing qualitative and quantitative sets of observations and with their presentation in the form of charts and diagrams. The scope includes the majority of the methods which have been generally employed in recent medico-statistical papers and the knowledge of which should therefore be considered to be an essential equipment of a medical research worker. Fully-worked-out numerical examples have been given to illustrate the application of these methods and this adds greatly to the usefulness of the book.

In a first edition some errors are likely to occur inadvertently and we may draw attention to the following—(i) figure 132 in the last line of page 21 should read 169; (ii) the probability of both twins being born alive has been shown incorrectly on page 26; (iii) in the third line from the bottom on page 83, II should replace I; (iv) the word 'tenth' should replace 'hundredth', in the fourth line from the top on page 8; (v) in the fifth line from the bottom on page 163 the limits should be from 2 sigma to  $2\frac{1}{2}$  sigma; (vi) in table I of appendix II for the values of 'X', after the value 1.00 the next nine values should be 1.10, 1.20, etc., and not 0.10, 0.20, etc. A similar correction is necessary throughout this table.

Certain paragraphs we feel could have perhaps been left out from this work, because they are likely to puzzle the non-mathematical reader. One of such para-

graphs is the last one on page 72 and another on page 116. For the purpose of carrying out comparisons between mean values and variations exhibited by different sets of data, the author has described methods which, though they were considered important some years ago, have now given place to statistically sounder tests. Tests on the lines of those suggested by the author on page 99 for comparing two standard deviations are not only out of date but are also inexact, and we feel it would have been better if the author had instead described the use of tests designed by Fisher which are easier to apply, and at the same time are valid for small as well as large samples.

The value of the book will be enhanced if, in the next edition, space is devoted to the description of tests which are valid for small samples, to a discussion of growth curves and life table, to certain fundamental considerations to be adopted in the designing of experiments and to an elementary exposition of the technique of the analysis of variance and covariance.

The appearance of a book of this type, written for medical men by a medical man, has long been overdue and we trust that it will now bridge the gulf that has existed between the mathematical teacher of statistics and the average medical research worker. The book bears the mark of having been written by an experienced teacher.

S. S.

**MATERIA MEDICA OF PHARMACEUTICAL COMBINATIONS AND SPECIALITIES.**—By Dr. U. B. Narayanrao. Second Edition. 1941. Published by 'Medical Digest', Girgaum, Bombay 4. Pp. xlix plus 322. Price, Rs. 7-12; postage, As. 10

IN the small space of 322 pages, the author has made an attempt to introduce short references of nearly 400 patent medicines of both indigenous and foreign origin, and has added special chapters on therapeutic index, hormone and vitamin therapies. The author has succeeded in giving much information, in a concise manner, regarding the composition, doses and indications of these specialities. The book also furnishes the name and address of the manufacturers of these patent drugs and enables the practitioner to find out substitutes if one or more of them are not available as a result of war conditions.

It is, however, to be regretted that Dr. Narayanrao has not been able to give a little more time and attention to the pharmacological side of these drugs and to investigate the relative values of various preparations, suggested for the same disease. It is obvious that a young practitioner will be puzzled in the selection of the right remedy when he has to choose one out of a dozen or so preparations, all claiming equal superiority, as is almost always the case with patent drugs.

With these limitations, the book will serve the purpose of a reference book on the patent drugs available in the market.

J. C. G.

**SURGERY OF MODERN WARFARE.**—Edited by Hamilton Bailey, F.R.C.S. Part III. 1941. E. and S. Livingstone, Edinburgh. Pp. 321 to 480. Illustrated. Price, 12s. 6d.; postage, 6d.

THE first few pages of this part conclude the section on wounds of blood vessels, and section V is a short

section on injuries to nerves and tendons. Section VI is perhaps one of the most important in the whole publication; it is concerned with methods of immobilization of the limbs. In the first chapter the different methods of applying extension are discussed, by adhesive plaster, by skeletal traction, and by pulp traction. The next two chapters deal with Thomas' frames and the Thomas' splint. Boehler's methods of the treatment of fractures are well described in chapter XLVII, and the various applications of Cramer wire frames in the following chapter. The section concludes with a very excellent chapter on the modern methods of applying plaster of paris.

In the section on the treatment of wounds of the hands and feet, the important teaching of Kanavel has been given the prominence that is due to it.

Section VIII, on wounds of bones and joints, has only two chapters in this part; these are on wounds of the knee and hip joints, respectively.

The editor is to be congratulated not only on maintaining the excellent standard of this important and timely publication amongst the din of bursting bombs, but also for keeping to his time schedule under these trying conditions.

#### STUDIES ON THE HUMAN THYROID IN ICELAND.—

By Julius Sigurjonsson. Pp. 130, with 10 illustrations. Obtainable from H. K. Lewis and Company, Limited, London (136, Gower Street, W.C.1). Price, 6s.

THE author has described, in this monograph, the normal features of the human thyroid in Iceland, especially with regard to the size and iodine content, the data having been collected from unselected autopsy material.

Chapters are devoted to the gross anatomy, histology, iodine content of the gland, effect of diseases, hyperplasia and the frequency of nodes.

The thyroid gland in Iceland appears to be very small as compared with the commonly accepted normal size, and its iodine content is rather high. It is interesting to note that remarkably small variation in the total iodine occurs in different localities in spite of the extremely wide variation in size of the glands.

The iodine intake is largely the determining factor in maintaining its concentration in the thyroid gland. When the total iodine, not merely the percentage, falls below a certain value, hyperplasia sets in as a compensatory reaction in order to increase the absorbing surface and thereby enable the gland to bind more iodine. Other factors may induce hyperplasia, probably by affecting the iodine requirement or utilization.

No significant variation was observed in the gland as a result of diseases of other organs or generalized diseases.

Small colloid nodes were frequently found, especially in advanced age and in females. They have been considered to be mostly due to unevenly proceeding compensatory hyperplasia.

The book contains some tables, and a list of references at the end. Anybody doing a special study of thyroid problems will find in this small book much that is interesting.

R. C.

#### RECENT ADVANCES IN THERAPEUTICS. PART I

(PART I IS COMPLETE ON 'SULPHONAMIDES').

—By J. R. Goyal, M.B., B.S. 1941. Published by the Manager, The Medical News, Burn Bastion Road, P. O. Box 81, Delhi. Pp. viii plus 88. Price, Rs. 2

SINCE prontosil initiated the era of chemotherapy almost each new member of the sulphanilamide group has been enthusiastically received. This has been largely due to the amazing results which have been obtained with each new preparation, of which sulphathiazole is the latest.

This little book, devoted entirely to sulphonamides, provides a brief account of the uses, doses, toxicity, etc., of its various derivatives. The writer has presented fairly good abstracts from the current literature. Radley Smith's view, that patients receiving sulphonamides can safely be given sulphur compounds at the same time, has been included, but we are at a loss to account for the statement recommending its administration in undulant fever in decreasing doses for at least two months after the subsidence of fever and symptoms.

Practitioners not having had access to current journals will find this booklet useful. There are some printing mistakes which will, we hope, be corrected in the next edition.

R. C.

**A PEEP INTO A CORNER OF THE INNER LIFE OF ANOPHELES.**—By P. C. Roy, M.B., D.P.H. 1941. Published by Messrs. S. C. Sarkar and Sons, Limited, 1-1-1C, College Square, Calcutta. Pp. 74. Price, Rs. 2-8-0

THE author of this booklet being the district health officer, Murshidabad, Bengal, for many years had ample opportunities to study the problem of anopheles and malaria in Bengal. He believes that the presence of pistia, the ubiquitous water plant of Bengal, is the main cause of increased incidence, as well as persistence of malaria in Bengal. His theory is that the anopheles larvae receive from pistia abundant supply of calcium sulphate in concentrated crystalline form and that this stimulates their growth and makes them stronger and hardier. Moreover these sharp-pointed calcium crystals damage the gut of the anopheline larva. The calcium imbibed in the larval stage makes the body richer in calcium in the adult stage. The adults are much stronger and hardier and live a longer life as they can stand the fight against the natural enemies better. This longevity is responsible partially for the increase in the incidence of malaria. In addition to this, the malaria parasites also grow better as they need a good deal of calcium for their growth and the parasites will pass more easily through the damaged guts than through undamaged ones.

Though the experimental proofs, in the laboratory, of the increased longevity of pistia-associated anopheles and gut-piercing are wanting, the author has tried to prove his theory by field experiment by reducing the incidence of malaria by the eradication of pistia in several villages of Murshidabad District side by side with control villages. The theory advanced by the author requires further elucidation by experimental as well as field work and corroboration by impartial observers. If this theory proves true, its application will go a long way in eradication of malaria in Bengal.

**BIRTH CONTROL SIMPLIFIED—DESCRIBING EFFECTIVE AND INEXPENSIVE MODERN METHODS OF AVOIDING PREGNANCY.**—By A. P. Pillay, O.B.E., M.B., B.S. Published by D. V. Taraporevala Sons and Company, Bombay (Hornby Road, Fort). Pp. ix plus 138. Illustrated. Price, Re. 1-14

CONCEPTION nowadays can be controlled with a fair degree of certainty by the use of contraceptives. The subject has been studied scientifically, and reliable methods and appliances have been introduced.

Here is a small volume on the subject specially written for the layman of this country. The author has incorporated in it all the modern contraceptive methods including some 'natural' ones. The text is sufficiently illustrated, and there is a glossary at the end of the book.

R. C.

## Abstracts from Reports

### THE ROCKEFELLER FOUNDATION, NEW YORK: A REVIEW FOR 1940. BY RAYMOND B. FOSDICK, PRESIDENT OF THE FOUNDATION

Of the money spent during the year, 77 per cent was for work in the United States and 23 per cent for work abroad. In spite of the serious interference of the war, the Foundation's activities during 1940 involved co-operative efforts in forty-four countries in Europe, Asia, Africa and the Americas.

For an organization like The Rockefeller Foundation which over many years has tried to carry on its work regardless of flags or boundary lines, these are unhappy days. To sit by and watch the disappearance or decadence or, worse, the perversion of institutions of learning which in earlier and better years we were privileged to assist is not an easy assignment. In the decade that followed the war these institutions gave high promise in public health, in medicine, and in the natural and social sciences. The Institute of Hygiene at Warsaw, the Institute of Public Health at Prague, the Kaiser Wilhelm Gesellschaft in Berlin, the Institute of Psychiatry at Munich, the Institute of Inorganic Chemistry at Gottingen—these were a few of many organizations, in a world where thought was free, to which the Foundation gave needed assistance.

Even more difficult is it to see the brilliant men with whose work we were associated—many of them on fellowships or with grants in aid from the Foundation—now driven from the posts for which they were trained, debarred from their laboratories, some of them fugitives, some in concentration camps, many of them separated from their families or lost in foreign countries where they sought haven. To these scholars scattered in many lands, whose lives are now a sacrificial testimony to the principle of intellectual freedom, we in this protected hemisphere pay tribute of admiration and homage. Under the regulations of the United States Treasury Department, to make payments on appropriations for work in the occupied areas of Europe, Norway, Belgium, Holland, Denmark, France, Rumania—the projects which were being supported in these countries in medical research and in the natural and social sciences cannot now be assisted.

The development of the war has had the further effect of driving back several of the Foundation's outposts established in connection with its own operating programme around the world. However, Foundation personnel is still operating on the Burma Road, in India, in South China, in the Belgian Congo, in Uganda (Central Africa), in Spain and Portugal and of course in Latin America.

On the continent, as distinguished from Great Britain, the situation during the last year has rapidly deteriorated. January 1941 finds a large number of universities and institutes closed, and many others working under conditions scarcely tolerable. As German forces have moved into one country after another a definite pattern has been followed in relation to the universities and other schools. Allowed at first to continue with their work, their teaching and student activities were closely supervised by the German authorities. The supervision involved an attempt to enforce a 'cultural programme' similar to that already imposed by the Nazis on German institutions. Where this attempt was resisted, as it frequently was, the measures of repression adopted by the occupying authorities included the 'closing' of the institutions, sending faculties to concentration camps and even breaking up student demonstrations with machine guns and tanks.

The condition of university life and standards on the Continent is now little short of appalling. As a result of flight, imprisonment or disappearance the number of professors in institutions has been reduced by at least 50 per cent. Jewish professors in France were discharged as a result of the September decrees issued

from Vichy, and similar action has been taken in other countries under German domination with the exception of Denmark. Professors residing in German-occupied territory who were known to be anti-Nazi have been taken to concentration camps or have disappeared. The same is true of German refugee scholars who had found haven in countries subsequently invaded by German troops. Similarly in the three Baltic states—Lithuania, Latvia and Estonia—which were absorbed by Russia in June 1940, the process of converting the universities into Soviet institutions has proceeded rapidly. More than half the professors have been removed from their positions and many of them have been imprisoned or have disappeared. The teaching programme has been completely reorganized, particularly in the social sciences.

In such surroundings scholarship withers and only through heroic struggle keeps itself alive. When the German Minister of Justice tells the Association of University Professors that the old ideal of objectivity was nonsense and that 'to-day the German university professor must ask himself one question: does my scientific work serve the welfare of National Socialism?' he is voicing a doctrine which if broadly applied spells the end of Western scientific thought. When relativity becomes 'an example of characteristically perverse Jewish thinking', and genetics is a battleground for the 'Aryan theory', then the end of the day has come in which Claude Bernard could say: 'I give small thought to where the truth will lead me, provided that I find it'.

The necessity of protecting the careers of scholars unable to continue work in their native lands has given rise to two Foundation programmes: one a placement programme, from 1933 to 1939; the other an emergency rescue programme in 1940.

In 1940, with the invasion of Scandinavia, the Lowlands and France, and the intensification of war in England, a new kind of problem arose, necessitating a new type of programme. Many eminent scholars, some of whom the Foundation had already rescued from Central Europe between 1933 and 1939, suddenly found themselves not only unable to continue their work, but often in extreme personal peril. The situation was an emergency one. Long negotiation such as was formerly necessary to secure permanent placement was now out of the question. In order to save these men, action had to be taken at once.

During 1940, on behalf of these refugee scholars, The Rockefeller Foundation made fifty-six grants totalling \$266,350. The fifty-six scholars represent eleven nationalities, including nineteen Germans, eleven French, seven Poles, five Russians, five Austrians, three Norwegians, two Spaniards, one Belgian, one Czech, one Italian and one Swiss. Among them were physiologists, biochemists, mathematicians, psychiatrists, neurologists, economists, statisticians, historians, philosophers and philologists, all of whom had occupied distinguished places in European universities. One was a Nobel prize winner; nearly all had international reputations.

Just before he died, Lord Lothian, British Ambassador to the United States, asked The Rockefeller Foundation whether it would consider the possibility of giving a number of British medical students the opportunity to complete their training in the medical schools of the United States and Canada.

Lord Lothian's suggestion was warmly supported by leading British medical authorities, and as a result the Foundation appropriated \$100,000 to initiate the plan.

Twenty-five leading medical schools in Canada and the United States have indicated their cordial willingness to accept these new students, and some have offered to remit tuition. An officer of the Foundation is now in England working with a British committee on the details of selection and transportation. Candidates will be considered not only from the London area but from the provincial universities in England, Scotland and Wales, where extensive damage has also been done to clinical teaching services. Arrangements are being made for the local supervision of the students in America and for the acceptance by

British medical authorities of their American training, when successfully completed, as the equivalent of the British licensure. Appointments will be for not more than three years and will provide modest living expenses and tuition. The three-year period is likely to include two years of clinical training and one year of internship. The student will be expected to provide his own cost of travel. He will, of course, be required to return to Great Britain upon the termination of his scholarship. The scholarship will be administered by the authorities of the school to which he is assigned, and it is not expected that he will be enrolled as a candidate for an American degree.

**Influenza.**—Toward the end of 1939 a curious accident occurred in the laboratories of the International Health Division of The Rockefeller Foundation in New York. An outbreak of distemper-like disease developed among the ferrets used in the studies of influenza A. In order to prevent the spread of the infection, a vaccine was made from the organs of some of the animals which had just recovered from influenza and had come down with the distemper; and this vaccine was injected into a large number of normal ferrets. When these vaccinated ferrets were later inoculated with influenza A virus, they were found to be immune.

This phenomenon, accidentally encountered, was intensively studied during the year 1940 in the hope that it might lead eventually to the development of a satisfactory anti-influenza vaccine. In the course of the work different types of vaccine were tried, and eventually, in place of infected ferret tissues, developing chick embryos were employed. The vaccine thus produced was studied in a number of human volunteers and was found to give a sharp rise in antibodies against influenza virus in the blood of vaccinated persons. In some instances this increase was over a hundredfold, and the high antibody level resulting from the experimental vaccination persisted for a number of months. Because these results seemed much more promising than those previously obtained with any other type of vaccine, it was considered desirable to determine whether the antibody rise in the blood indicated active immunity to influenza.

Plans were therefore made to vaccinate representative groups in different parts of the country in the expectation that during the usual winter influenza season epidemics might affect some of the localities under study and thus give an answer to this crucial question.

During the midwinter an extensive outbreak occurred throughout the southern states. In Florida and Alabama a large number of persons had been vaccinated four months previously. Although complete data are not available for statistical analysis at the time this report is being written, the preliminary survey indicates that the incidence of influenza on the whole was somewhat lower among the vaccinated persons than among the unvaccinated.

The results which are available to date suggest that, although this vaccine is by no means perfect, it may have some practical value as a prophylactic measure against one type of influenza.

**Yellow fever.**—The year 1940 was marked by a sharp outbreak of yellow fever in the Nubian Mountains of the Anglo-Egyptian Sudan, involving thousands of cases and many deaths. The infected area had been shown to be endemic in a survey made by the Rockefeller Foundation in 1933 and 1934. This new epidemic was probably transmitted by the *Aedes aegypti* mosquito, although there is a bare possibility that other vectors were involved. Information recently received shows that the outbreak has largely been confined to the native population and apparently it has in no way been related to the movement of troops.

At the request of the British Government The Rockefeller Foundation has sent to the Sudan 250,000 doses of the yellow fever vaccine developed in the laboratories of its International Health Division and is preparing to send an equal amount in the near future. In this connection it should be reported that the Foundation is supplying yellow fever vaccine to the United States Army for the vaccination of military personnel, as well as to the United States Public

Health Service. The amounts involved may run to over a million doses.

As a result of the several avenues of investigation followed in Columbia, the tentative generalizations appear to be: 1. The jungle yellow fever.

1. Yellow fever is primarily a disease of jungle animals. The classical form involving transmission from man to man by the *Aedes aegypti* mosquito is more of a secondary cycle depending largely upon conditions of population concentration and mosquito breeding created by man himself.

2. Transmission of jungle yellow fever appears to be by jungle mosquitoes from animal to animal.

3. There is no animal reservoir of virus in the usual sense. Virus continues to circulate in the blood of susceptible animals for three or four days only, and does not subsequently reappear. Mosquitoes, however, once infected tend to harbour the virus for the remainder of their lives, which may be several months under favourable conditions.

The most important control procedure with respect to jungle yellow fever is the vaccination of that part of the population which comes into contact with the infected forest area. It now appears that protection test studies in wild animals can be of great value in determining the risk to human beings entering a region. Previously, it was necessary to wait until human deaths occurred before considering the region as one of yellow fever interest. To-day the findings among the animals may be used to orient the vaccination campaign in order to give maximum protection.

The discovery that yellow fever can be transmitted in the jungle by carriers other than the *Aedes aegypti* mosquito does not minimize the significant part which the *aegypti* mosquito plays in the distribution of the disease among human beings. It is not too much to assert that if in urban areas this insect were brought under control as it has been in Brazil, the world could avoid the threat which in these days of fast transit might so easily develop into a cataclysm in East Africa, in India and even in the Orient, to say nothing of parts of the Americas, should the virus of yellow fever break through the barriers of quarantine, vaccination and medical vigilance.

#### REPORT OF THE SUDAN MEDICAL SERVICE FOR THE YEAR 1939

**Kala-azar.**—Three hundred and eighty-seven cases were reported with 104 deaths.

The distribution of the disease in the Sudan remains the same and the long endemic area along the whole length of the Italian East African frontier provides nearly all the cases.

Investigations are being carried out regarding the aetiology of this disease. No appreciable difference in incidence is recognizable from year to year and it appears to remain mildly endemic under normal public health conditions. The disease is of public health importance owing to the possibility that any lowering of the general standard of resistance by malarial or food scarcity might result in its becoming epidemic and invading the Gezira and other important thickly populated areas to the north. Much work is being carried out in Singa testing various new drugs in an attempt to discover more satisfactory methods of treatment than are available at present.

**Sanitary control of aircraft.**—Inspection and disinfection of aircraft has been centralized on Khartoum except where aircraft make a night stop at an airport near the frontier. On the west to east air route from West Africa these measures are carried out at Geneina and again at Khartoum. All passengers entering the Sudan from the west must be in possession of a certificate stating that they have not been exposed to the risk of infection with yellow fever during the previous six days. At Khartoum no mosquitoes of any kind were found on aircraft during the year. During 1939, 433 telegrams were despatched by the public health authorities of Khartoum to Egypt, India,

and other parts of Africa in connection with the control of yellow fever. At Gencina one infection of anopheles was found on an eastward bound machine.

#### REPORT ON THE STACK MEDICAL RESEARCH LABORATORIES

*Research.*—Apart from the continued malarial survey in the Gezira, the principal subject of research has been kala-azar. This has been carried on uninter-ruptedly throughout the year.

*Routine and educational activities.*—The total 24,540 represents an increase of approximately 2,000 specimens over the 1938 figure, and the increase has been chiefly accounted for by a larger number of Kahn tests and Widal reactions.

Following the policy of decentralization commenced at Port Sudan, several other hospital laboratories, have been equipped, during 1939, with the necessary apparatus and reagents for the Kahn test and selected Sudanese laboratory assistants were given special training in the performance of this test. The standard of accuracy obtained under expert supervision has been high but whether it will remain so when they are left on their own responsibility remains to be seen.

The positive isolations for bacillary dysentery and typhoid fever were much fewer than 1938, probably owing to the very light rains in Khartoum during the summer.

Owing to the outbreak of war a great deal of extra work in blood typing of volunteers, and preparation of blood transfusion apparatus has been thrown on the laboratory staff, but as such work can hardly be considered either routine or research, the figures are not included in this report.

There has been no increase in the number of hospital laboratories as with one or two exceptions all hospitals are now furnished with laboratory facilities. The total cadre of Sudanese laboratory assistants is 32 and their training and refresher courses remain unchanged.

*Jaundice of obscure aetiology.*—Livers from five cases were received during the year three of which were viscerotome specimens. In two cases it was possible to make a fuller examination, the results of which are summarized.

The first case, from Juba, showed an extensive acute necrosis with scattered fatty degeneration of the liver cells and an almost complete loss of structure of the lobule. Small foci of lymphocytes were sparsely scattered throughout the liver, but otherwise signs of acute inflammation were absent. The kidneys generally showed cloudy swelling but in some places there was an acute necrosis of the convoluted tubules, their lumina being filled with debris. The spleen showed no changes of note. The second case came from Omdurman Hospital and it has been possible to get clinical details. The patient—a Sudanese aged 22—was admitted with history of about three days' fever and died of sudden collapse four days later. Jaundice increased progressively and was deep at the time of death. The temperature ranged between 104°F. at night accompanied by rigors, and 99°F. in the mornings. Blood count showed leucopenia—the leucocyte count being 4,000—but no other abnormal changes. Examination for parasites negative. The spleen and liver were tender and enlarged (about 3 fingers). At post mortem the spleen and liver were large and soft; the other organs appeared normal.

Owing to the mistake of a native driver the organs were received 24 hours later and as the weather was hot they had undergone considerable putrefactive changes but it was possible to obtain sections of the liver. These showed a curious patchy necrosis ranging from some areas of a roughly mid-zone distribution to others in which destruction of the polygonal cells was complete. Fatty degeneration was scattered throughout but was not of marked degree. There was sparse infiltration of plasma cells and lymphocytes but no other signs of inflammation. Two other livers (viscerotome) showed such complete necrosis that it was difficult to identify the organ. In neither was

there any inflammatory reaction apart from scattered lymphocytes.

It is curious that in spite of intense jaundice none of these livers shows evidence of bile stasis.

The clinical course of these fatal cases of jaundice appears to be short and, although estimates before admission to hospital must be accepted with caution, in most cases the illness appears to last between five and eight days. There is some evidence to suggest, that if not fatal within this period, the chances of recovery are good.

Practically nothing is known about the regenerative changes in patients who recover but one specimen examined this year may throw some light on the matter; unfortunately no clinical details were supplied in this case.

The liver showed the usual areas of acute necrosis but in other areas there was evidence of a marked and rapid regeneration of the polygonal cells. There was a marked infiltration of lymphocytes and large mononuclears in Glisson's capsule and the appearance was that of an early multilobular cirrhosis. This condition is not uncommon in the Sudan and although some of the cases may be of bilharzial origin, in others there is no such history and it is possible that they represent later stages of this obscure jaundice syndrome.

*Kala-azar.*—The preliminary sandfly survey has been completed. The distribution of thirteen species or varieties has been recorded and it has been shown that at least six of these can bite man. It is interesting to note, that four of these six belong to the sub-genus *Prophlebotomus* Parrot, members of which were believed until recently to bite only cold-blooded animals. Infection of the skin has now been demonstrated in quite a high proportion of cases of kala-azar, suggesting that it is probably from this tissue that the vectors may take up the parasites, rather than from the blood.

The frequent occurrence of parasites in the skin, but not in the blood, suggests that the lymphatics may play an important part in the spread of infection through the body. It has been found that diagnosis can be confirmed in a high proportion of cases by finding parasites in the 'juice' obtained by gland puncture.

The glands to be punctured are the lower group of the superficial inguinal lymph glands, which are disposed vertically along the terminal part of the long saphenous vein. They can usually be readily palpated if a deep grip is taken with the thumb and forefinger. The skin having been sterilized, the glands are identified, pulled up from the underlying tissues and steadied above the thumb and forefinger of the operator's left hand. A dry, sterile hypodermic needle (no. 16 is a convenient size) is pushed through the skin and into the gland by the right hand of the operator. No syringe is attached to the needle, as once the gland has been penetrated the juice runs up into the needle of its own accord. It is usually easy to feel when the needle has entered the gland. Once the needle has entered the gland, it is held there for a second or two, then quickly withdrawn and attached to a small syringe, by means of which the 'juice' in the needle can be blown out on to a slide and a smear made and stained in the usual way for examination. With practice, the operation can be carried out very rapidly, and the amount of danger or discomfort to which the patient is subject, is negligible.

It has been recognized that a more effective specific is urgently needed in the Sudan, where the results of treatment of kala-azar with antimony preparations compare unfavourably with those reported from other countries. In collaboration with Professor Warrington Yorke, work has been undertaken during the latter part of 1939 to test the effectiveness of a series of very actively trypanocidal substances which have been produced by the Liverpool School of Tropical Medicine. The preliminary results with one of these (at present designated M. & B. 744) are encouraging, but it is too early yet to assess its final effectiveness.



**KING EDWARD VII MEMORIAL PASTEUR INSTITUTE AND MEDICAL RESEARCH INSTITUTE, SHILLONG. THE TWENTY-THIRD ANNUAL REPORT FOR THE YEAR ENDING 31ST DECEMBER, 1939**

THE treatment was carried out at Shillong and its authorized treatment centres which now number 24 public centres and 44 private centres. Two new private centres were authorized during the year.

Two thousand three hundred and thirteen persons applied for treatment at Shillong and its centres, the majority at the centres. Of these persons 1,986 or 111 more than in 1938 completed treatment and among these there were 8 deaths from hydrophobia. In addition 2 persons applied for treatment when they were in the late incubation stages of hydrophobia and did not complete treatment because the disease supervened during the course of treatment. Both died. Thus among persons applying for treatment there were 10 deaths from hydrophobia during the year.

There were 182 'advice cases' who did not receive treatment or whose treatment was discontinued because they were considered to be at no risk. One hundred and fifty-two of these advice cases were among persons attending the Institute at Shillong. Of the individuals placed under treatment and presumably at risk, 142 absconded before completing the course and there is no record of their eventual fate. In all these cases repeated efforts were made to induce these persons to complete their treatment, but without success.

There was one paralytic accident during the year, unfortunately of the fatal ascending myelitis type. This case occurred at one of the private centres. The patient was a woman 54 years of age bitten on the leg by a dog suspected to be rabid. The dog was killed and no examination of the brain was done. The patient reported for treatment on the third day after being bitten and developed symptoms of myelitis with pain in the lumbar region and paralysis of the lower part of the body including the sphincters, on the 13th day of treatment. The paralysis was progressive and she died with increasing difficulty in breathing two days later. At no time during the illness did the patient exhibit hydrophobia or convulsions.

With this case, the number of 'paralytic accidents' occurring as a result of antirabic treatment over the past five years has been 1 in 4,520 persons treated. The cause of these 'accidents' is quite unknown and there is unfortunately no known way of forestalling them.

*Assam Medical Research Society*

Dr. Rice, the Research Officer, retired from the service of the Society from 6th March, 1939, and Dr. D. K. Viswanathan, the present Research Officer, took charge on the 13th October, 1939. During the interim period the duties of the Research Officer were carried out by the Society's Malariologist.

**Malaria surveys.**—Based upon the findings in the bhil survey referred to in last year's report a comprehensive report was submitted to the tea estates in Doom Dooma district stressing the need for joint effort with the co-operation of the Government for controlling Government-owned land. A full year's survey was carried out in Gillapukri Tea Estate and a report submitted.

**Experimental control projects.**—These were continued in 4 urban and 2 rural areas, and the results reported during the last year were not only maintained but even bettered in all but one urban and one rural area. In Gauhati Town the spleen rate was 7.2 per cent as against 5.4 per cent in the previous year and the parasite rate was 6.8 per cent as against 2.6 per cent in the year before. The Gauhati civil hospital figures show a considerable increase in the number of malaria cases treated in 1939, but as it caters both for urban and the surrounding rural areas it is apparent from the spleen rate furnished above that increased malarial prevalence in the neighbourhood affected Gauhati but slightly. The rural centre in Dishpur offered special difficulties for antilarval work on account of the obstructive attitude of the villagers in putting up bunds and removing oil booms. Besides the extent of breeding

grounds was very large and the cost of treating them disproportionately large for the small size of the population. Hence during the current year spraying houses with Pyrocyde 20 has been instituted.

**Treatment schemes.**—This was continued with good results in Doom Dooma. The spleen rate in December 1939 was only 12.4 as against 56.5 per cent seven years previously when work was first started. The treatment scheme is however reinforced with antilarval work.

**Technical guidance in routine control projects.**—The Society continued to offer its technical guidance for all routine malaria control projects under the Public Health Department, and in tea gardens where the initial recommendations were made by the Society.

The report of the activities of the Society described from year to year clearly demonstrates that the purpose for which the Society was instituted is well served and all interests in the province are benefited by its activities. This province enjoys the unique distinction of having a separate research organization for the control of malaria and other communicable diseases. By reason of its being the greatest menace to the public health of Assam malaria doubtless engages the primary attention of the Society. Its constitution makes it possible to secure the co-operation of all interests in the province and pool their resources while the Government continue to obtain all the technical assistance from the Society. A time has now arrived for the Government of Assam to profit by the endeavours of the Society in the past and to undertake the control of malaria in an organized manner over the whole of the province in its twin aspects of extensive relief to the malarial sick by a wide distribution of the cinchona alkaloids and intensive control in selected areas both rural and urban. In carrying out such a policy the Society may be expected to play a useful and important rôle.

*Cholera enquiry under the Indian Research Fund Association*

During the first quarter of the year under review, the enquiry started in the previous year under Dr. S. R. Pandit was brought to an end and the investigations were transferred to Bengal.

Experiments carried out by Captain A. C. Vardon, I.M.D., and described in previous reports, had suggested a relationship between variants of the cholera vibrio, and produced in the laboratory by the action of bacteriophage, and certain water vibrios whose biochemical and serological reactions indicated an affinity to the true vibrio of cholera.

Certain vibrios isolated from natural water supplies and belonging to Heiberg's fermentation groups I, II and V, were found to be lysed by certain types of bacteriophage and to exhibit agglutination with 'O' sera prepared from some of the artificially prepared cholera vibrio variants, though not agglutinated by Inaba or Ogawa 'O' sera. These reactions closely paralleled the reactions of certain of the bacteriophage-produced variants of *V. cholerae*. It was therefore thought that these water vibrios might also be variants of the true cholera vibrio produced in nature by the action of bacteriophage and that removal from them of their bacteriophage resistance might cause them to revert to the true cholera vibrio.

How to bring about this reversion was the problem Captain Vardon set out to investigate. In this preliminary work an attempt was made to remove the bacteriophage resistance from the water vibrio bodies by growing the strain in the presence of appropriate anti-phage sera. It may be said that under the conditions of the experiment no diminution in phage-resistance was obtained by this method and the reactions of the vibrios remained practically unchanged after repeated passage in the presence of anti-phage sera.

**REPORT OF THE BOTANICAL SURVEY OF INDIA FOR 1939-40**

**Cinchona and quinine.**—At the beginning of the year the Government of India ceased to have responsibility



for the distribution of quinine to the provinces and states and sales remained restricted to the centrally administered areas of Ajmer-Merwara and Baluchistan. Coorg, however, got a free supply of 200 lb. and Bihar had 1,500 lb. at replacement cost as a special case from the stocks at Mungpoo.

The recommendations of the Wilson Report have yet to be implemented in full. The Imperial Council of Agricultural Research has, however, been evolving a scheme of research on cinchona. Enquiries from provinces and states indicate some interest in its cultivation.

**Mungpoo factory.**—There was no extraction of bark during the year. Conversion of quinine for the Government of India was also very small. The Government of India stocks at the factory at the end of the year were 84,850 lb. quinine, 7,102 lb. cinchona febrifuge, a small quantity of tablets and 256,106 lb. of unextracted bark.

**Indian Museum.**—Owing to the restriction of sale distribution from the Indian Museum was small. Sales of quinine to Ajmere and Baluchistan made a total of only 310 lb. The stocks in the Indian Museum at the end of the year were 7,694 lb. quinine, 1,110 lb. cinchona febrifuge and 44 lb. cinchona tablets.

**Financial.**—Out of the total grant of Rs. 16,600 for the cinchona portion of the budget of the Botanical Survey of India an expenditure of Rs. 5,292 was incurred. The bulk of the grant for extraction of quinine from bark and conversion of quinine into tablets was surrendered to Government.

#### ANNUAL REPORT ON THE CIVIL HOSPITALS AND DISPENSARIES IN THE CENTRAL PROVINCES AND BERAR FOR THE CALENDAR YEAR 1939

The salient features of the year were—(1) the steps taken by Government in extending medical relief in rural areas by (a) the establishment of *ayurvedic* and *unani* dispensaries, (b) increasing the number of allopathic dispensaries and (c) subsidizing allopathic, *ayurvedic* and *unani* medical practitioners and (2) the appointment of a committee for improvement of all the bigger hospitals and the medical school in the province.

**Hospitals and dispensaries.**—At the close of the year 1938 there were 362 hospitals and dispensaries in the province; 21 new dispensaries were opened and one private-aided dispensary was made a cheap-plan dispensary during the year under review. On the 31st December, 1939, therefore, there were 383 dispensaries, 204 in the rural areas and 179 in the urban areas.

Medical relief in rural areas is still inadequate and attempts are being made to expand it. Government made a provision in the budget for the year 1939-40 for the establishment of 83 *ayurvedic* and *unani* dispensaries in the rural areas and for 83 *vaid*s and *hakims* to settle in rural areas on subsidized system one in each *tahsil*. Allopathic dispensaries are also being increased, and arrangements are being made for 22 private medical practitioners to settle down, one in each district council rural area.

So far, subsidized medical practitioners have been appointed in the areas of the district councils, Nimar, Narsinghpur, Yeotmal and Damoh. Places for subsidized practitioners have also been selected in other district council areas but candidates passed from the Robertson Medical School, Nagpur, were not available for appointment. It is now intended to invite applications from candidates passed from medical schools outside the province but who are residents of this province. No appointments of subsidized *vaid*s and *hakims* have so far been made as action in the matter was held over for some time in view of the need for economy due to financial stringency. Action in the matter is being expedited and it is hoped that these *vaid*s and *hakims* will be appointed during the year 1940.

Establishment of *ayurvedic* dispensaries, one in each *tahsil*, has been sanctioned under the district councils, and it is hoped that *vaid*s at the dispensaries will soon

be appointed and that the dispensaries will function soon. Four *ayurvedic* dispensaries were opened.

A Provincial Hospitals' Enquiry Committee has been appointed by Government to suggest ways and means for the improvement of the provincialized hospitals at Nagpur, Jubbulpore, Raipur and Amraoti, the Main Hospital, Akola, and the Robertson Medical School, Nagpur.

**Nurses.**—The nursing staff in the Central Provinces and Berar hospitals is not up to the strength required. The four training centres for probationer nurses—the Mayo Hospital, Nagpur, the Victoria Hospital, Jubbulpore, the Silver Jubilee Hospital, Raipur, and the Irwin Hospital, Amraoti, continued during the year. A scheme for the training of male nurses in the province is still under consideration. Staff nurses were employed at the main hospitals, Saugor, Wardha, Akola and Bilaspur, and the appointments of such nurses at the main hospitals, Yeotmal, Hoshangabad and Bhandara, have been sanctioned during the year. The question of revising the scale of pay of the nursing staff employed in the provincialized hospitals in the province is under reconsideration.

**Honorary physicians and surgeons.**—Honorary medical officers are being employed in large numbers at the provincialized and other main hospitals as surgeons, physicians, dentists, radiologists and specialists in eye, ear, nose and throat diseases. They proved of great assistance to the staff and performed their duties with great zest.

Thus the total number of patients treated, both in- and out-door, stands at 4,323,056 (4,006,612) showing an increase of 316,444 over the past year. The increase is noticed in all the districts excepting Akola and Buldana. Of the total number treated 4,212,117 (3,899,814) were treated in the general hospitals and dispensaries and 110,939 (106,798) in the women's hospitals. The above statistics of attendance and work done in the medical institutions referred to give further indication of the growing appreciation by the public of their activities.

Malaria as usual remained the chief prevailing disease during the year. The number of cases treated for malaria during the year was 889,265 showing an increase of 183,881 over the figures of the past year (705,381). The increase is noticeable in all districts except Nimar 31,635 (32,194).

Four tuberculosis clinics in the province, one at each divisional headquarters and the Union Mission Tuberculosis Sanatorium at Pendra Road where the Government maintains 40 beds at its own expense did excellent work during the year. Dr. C. Frimodt-Møller, Medical Commissioner to the Tuberculosis Association of India, visited the tuberculosis clinics at Nagpur, Jubbulpore and Amraoti, and the tuberculosis sanatorium at Pendra Road, in November 1939. The suggestions regarding improvements to the clinics are being examined along with the whole question of dealing with the problem of tuberculosis in the province and a report will be submitted to Government in due course.

**Treatment of venereal diseases and yaws.**—Well-equipped centres have been organized at various district headquarters for the treatment of venereal diseases and the Government has sanctioned a special annual grant of Rs. 8,000 for treatment of these diseases on modern lines. The disease yaws is prevalent amongst aboriginals of Sironcha and Garchiroli tracts in the Chanda district. The treatment for this disease was started from the year 1936. The assistant medical officers in charge of Ahiri, Bhamragarh, Allapalli and Sironcha dispensaries were supplied with medicines by the Director of Public Health, Central Provinces and Berar, and treated 1,741 cases.

As in the past the deputy commissioners and commissioners comment on the progressive reduction and unpunctual payment of contributions to hospitals and dispensaries by local bodies. Local bodies are inclined to take their responsibility in regard to provision of medical relief lightly. The Deputy Commissioners, Akola, Yeotmal, Buldana and the Commissioner of the division have remarked that the financial condition of the main hospitals is extremely bad owing to reduction

or non-payment of grants by the local bodies and to the stoppage of payment of deposits by co-operative banks in which funds are locked up. The Commissioner, Berar, is of opinion that the only alternative that he sees to closing the hospitals is that Government should prescribe a minimum percentage of income which every local body must devote to medical relief. Deputy commissioners suggest that the amounts payable to hospitals should be deducted by the Government from the grants given to local bodies for general purposes and paid to hospital funds direct.

## Correspondence

### IDEAL MARRIAGE

SIR,—As a medical man interested in spreading sound knowledge of sex hygiene, I wish to protest against the irresponsible nature of the review of *Ideal Marriage* by Th. Van de Velde, printed on page 376 of your current number.

I read the review hoping for some information about the book and its contents. I found practically no such information. Instead I found a piece of writing of the type which I feel does harm to the cause it pretends to serve.

There are many points in the review on which I might comment. I will mention a few.

Why compare the degree to which this book and the *Bible* are or may be read? Is the implication that this is a new and better *Bible*? The suggestion that a study of this book might be made compulsory in all colleges in the world, would indicate that this implication is intended. Although not a professing Christian, I would oppose both the implication and the suggestion. The two books are in different realms. And why compulsory study? Surely most college students will have already studied this or some similar book. The market is flooded with them.

And surely it is nonsense to say that 'the credit for establishing man's claim' to the title *Homo sapiens* 'will belong to this wise cultured Dutch doctor'. Does the reviewer really think that a knowledge of sexual matters is all that is needed to make man wise? What an extraordinarily superficial view of man, history and wisdom!

And surely other writers deserve some credit. Does Van de Velde's book contain anything wonderful that is not contained in other books of a similar nature? If so the reviewer has neglected his duty in not indicating what this is.

The remarks about 'awareness of sex and all that it connotes' not being reached 'until we are among quite primitive peoples' and about knowledge of sex being 'in inverse ratio to what is ordinarily called civilization' are open to criticism. A good deal depends on what we mean by 'awareness' and knowledge.

The wisest sentence in the review is that which points out that only a fraction of the lack of awareness and knowledge can be attributed to oriental asceticism and early Christian writers, but this is immediately followed by a feeble joke in very questionable taste about the lack of definite instruction concerning coitus in the writings of Mahammed.

The whole review creates the impression that in the reviewer's opinion, sexual intercourse is the main if not the only important thing in life.

The review appears to me and to others to be unbalanced and irresponsible, not the work of a 'wise and cultured doctor'. It tells us practically nothing about the book under review.

I appeal to you to give us more balanced and more informative reviews of books on such subjects.

JOHN LOWE.

LEPROSY RESEARCH DEPARTMENT,  
SCHOOL OF TROPICAL MEDICINE,  
CALCUTTA.

[Note.—The writer of this review is one of our most competent and experienced reviewers. His initials were omitted inadvertently, but in the circumstances we do not propose to disclose them.]

We are, naturally, not in entire agreement with our correspondent, but, as he has expressed a point of view that may be shared by others, we welcome his letter. It is unlikely, however, that we shall publish any further letters on this subject.—EDITOR, I. M. G.]

## Service Notes

### APPOINTMENTS AND TRANSFERS

COLONEL E. S. PHIPSON, C.I.E., D.S.O., I.M.S. (Retired), is appointed, with effect from the 7th April, 1941, to officiate as Health Officer, Simla, *vice* Major F. M. Khan recalled to temporary military duty.

The Governor is pleased to appoint Colonel W. C. Paton, M.C., Inspector-General of Civil Hospitals and Prisons, North-West Frontier Province, to act as Surgeon-General with the Government of Bengal, with effect from the 16th May, 1941, *vice* Major-General P. S. Mills, K.H.P., C.I.E.

Lieutenant-Colonel W. Ross Stewart, C.I.E., to be A. D. M. S. of a Division. Dated 1st February, 1941.

Lieutenant-Colonel E. C. A. Smith, Superintendent, Central Mental Hospital, Yeravda, has reverted to military duty. He was relieved of his civil duties on the forenoon of 20th May, 1941.

Lieutenant-Colonel W. C. Spackman transferred as Inspector-General of Civil Hospitals, Bihar.

Lieutenant-Colonel H. E. Murray, officiating Professor of Midwifery, Medical College, Calcutta, is appointed to act as Superintendent of the Medical College Hospitals, Calcutta, in addition to his own duties, *vice* Lieutenant-Colonel J. C. De, granted leave.

Lieutenant-Colonel F. J. Anderson, C.I.E., Professor of Surgery, Medical College, Calcutta, is appointed to act as Principal of the Institution, in addition to his own duties, *vice* Lieutenant-Colonel J. C. De, granted leave.

Lieutenant-Colonel F. J. Anderson, C.I.E., I.M.S. (Retired), Professor of Surgery, Medical College, Calcutta, and Lieutenant-Colonel A. Denham-White, I.M.S. (Retired), to be Honorary Surgeon and Honorary Physician respectively to His Excellency in Calcutta. Dated 15th May, 1941.

Major K. S. Fitch, Civil Surgeon of Darjeeling, to be Honorary Surgeon to His Excellency at Darjeeling. Dated 15th May, 1941.

Major H. S. Waters transferred as Professor of Midwifery and Gynaecology, Grant Medical College, and Specialist in Obstetrics with Gynaecology, Bai Motlibai and Sir D. M. Petit Hospitals, Bombay, *vice* Lieutenant-Colonel W. C. Spackman.

On relief of his duties as Civil Surgeon, Belgaum, Major H. S. Smithwick is posted as Civil Surgeon, Poona, *vice* Major H. S. Waters.

Major W. Scott, Civil Surgeon, Amraoti, who was granted leave for 1 month from 31st March, 1941, was posted to Hoshangabad with headquarters at Pachmarhi from 3rd May, 1941.

Major G. B. W. Fisher, 1st Resident Medical Officer, Presidency General Hospital, Calcutta, is appointed to act as Surgeon Superintendent of the same institution, *vice* Major J. C. Drummond, granted leave.

Captain J. Lightbody to be Staff Captain (Medical), Medical Directorate, Army Headquarters, to fill a new temporary appointment. Dated 13th March, 1941.

Captain W. M. Niblock, 2nd Resident Medical Officer, Presidency General Hospital, Calcutta, is appointed to act as 1st Resident Medical Officer of the same institution, *vice* Major G. B. W. Fisher.

Captain John Brebner made over charge of the Chittagong Jail to Dr. Subodh Chandra Gupta on the forenoon of the 1st May, 1941.

## LEAVE

Major-General (local Lieutenant-General) W. H. Hamilton, C.B., C.I.E., C.B.E., D.S.O., K.H.P., Director of Medical Services in India, is granted privilege leave for 3 months, with effect from the 12th April, 1941.

(This General Officer will vacate his appointment on the expiry of the leave granted.)

Lieutenant-Colonel J. C. De, Principal, Medical College and Superintendent, Medical College Hospitals, Calcutta, is allowed leave for 2 months, with effect from the 10th May, 1941.

Major G. Kelly, Professor of Clinical Medicine, Medical College, Calcutta, is allowed leave for 6 months *ex-India*, with effect from the 29th March, 1941.

## PROMOTION

*Lieutenant-Colonel to be Colonel*

R. L. Vance. Dated 27th March, 1941, with seniority from 15th February, 1937.

*Captains (Acting Majors) to be Temporary Majors*

W. Mackie. Dated 20th July, 1940.

G. S. N. Hughes. Dated 1st March, 1941.

## RETIREMENT

Lieutenant-Colonel J. M. R. Hennessy. Dated 7th May, 1941.

## Notes

## 'TABLOID' PHENOBARBITONE AND BROMIDE

THE simultaneous administration of potassium bromide and phenobarbitone is a valuable therapeutic measure in the treatment of nervous diarrhoea and other types of gastro-intestinal dysfunction in which sedative and antispasmodic medication is indicated. These medicaments are effectively and conveniently combined in 'Tabloid' phenobarbitone and bromide, a recent addition to the range of products issued by Burroughs Wellcome and Co., Snow Hill Buildings, London, E.C.1. Other conditions in which it may be prescribed include epilepsy and allied disorders involving hyperexcitability of the motor cortex, delirium tremens, nervous insomnia and thyrotoxicosis. The product presents soluble phenobarbitone gr. 1/3, with potassium bromide, gr. 7, and is issued in bottles of 25 and 100.

## HEXÆSTROL

RECENT work on synthetic oestrogenic compounds has established the clinical value of hexæstrol (4:4'-di-hydroxy- $\gamma$ : $\delta$ -diphenyl- $n$ -hexane), a substance closely related to diethylstilbæstrol both in constitution and physiological action, but somewhat less toxic than the latter and consequently less liable to produce undesirable side-effects.

The compound is now issued by Burroughs Wellcome and Co., Snow Hill Buildings, London, E.C.1, as Tabloid hexæstrol, a sterile solution in oil for intramuscular injection. It may be used in all conditions in which oestrogen therapy is indicated, and is particularly valuable in the symptomatic treatment of the menopausal syndrome and in atrophic conditions of the vagina.

## DEXTROSOL AND ENERGY

PLAYING East Freemantle in the final of the West Australian National Football League's competition, under Australian rules recently, Claremont made an astonishing recovery in the second half, and finished the game with a 23 points lead after being 38 points in arrears at half-time.

The secret of their amazing rally when all seemed lost was that at half-time each member of the team was given 'Dextrosol', which, in the words of a spectator, 're-energized them to such an extent as to make them almost a new team'!

Interviewed after the game, the Claremont chairman frankly admitted that the success of his team was largely due to 'Dextrosol'.

One week later, again pinning their faith to 'Dextrosol' as a re-energizer, Claremont lifted another trophy in the final of yet another cup competition.

## HORLICKS SPONSORS FREE THEATRE IN LONDON FOR DEFENCE FORCES

HORLICKS LIMITED of England has instituted a daily three-hour entertainment in a London theatre where all 1,200 seats are free and are set aside for the exclusive use of the civil, navy, army, and R. A. F. defence workers, and the women's branches of the various services.

The entertainment consists of films, a well-known orchestra, four or five vaudeville 'turns' and community singing. On Sundays, one-half hour of the programme features the country's leading theatrical talent with such outstanding stars as Vivien Leigh, Lawrence Olivier, John Gielgud and others.

This half hour has become such a feature that, under the title of 'Colonel Horlick's Matinee for the Forces and Civil Defence Services', it is broadcast by the B. B. C.

The project has been a success from the first, according to the London Office of J. Walter Thompson Company which produces the show. The theatre has been packed every day.

## Publishers' Notice

SCIENTIFIC Articles and Notes of interest to the profession in India are solicited. Contributors of Original Articles are entitled to receive 25 reprints *gratis*; additional reprints can be obtained on payment. No reprints will be supplied unless contributors ask for them at the time of submitting their manuscripts.

The preparation of reprints entails rearranging the type, so that there is often a delay of a month or more, after the publication of the *Gazette*, before the reprints are ready. If reprints are not received within two months of publication of the *Gazette*, contributors should write to the Publishers.

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The Editors of *The Indian Medical Gazette* cannot advise correspondents with regard to prescriptions, diagnosis, etc., nor can they recommend individual practitioners by name, as any such action would constitute a breach of professional etiquette.

## Original Articles

### REPORT ON THE EPIDEMIC OF ORIENTAL SORE IN DELHI

By M. H. SHAH, M.R.C.P. (Lond.), D.P.M. (Eng.)

MAJOR, I.M.S.

Civil Surgeon, Delhi

#### Introductory note

ORIENTAL sore is a specific infective granuloma of the skin which breaks down to form large chronic indolent ulcers lasting for several months. Sores may be single or multiple, and being usually present on the exposed parts of the body often cause severe disfigurement. They result from infection by *Leishmania tropica* which is generally believed to be transmitted through the bites of infected sand-flies. Although a large number of remedies have been suggested as 'specifics', only a few of them can be recommended with any degree of confidence, patients having a common tendency to drift to the *jarrahs* who are reputed to have more effective cures for the sores.

The disease is widely distributed throughout the world. It is endemic in several parts of Asia, Africa and cases have been reported from different parts of Southern Europe and Australia. Nearer home the whole of the western and drier portions of the Indo-Gangetic plain from N. W. F. P. and Baluchistan on the west to Delhi on the east is a big endemic centre; the sores in this area being known by the names Quetta sores, Lahore sores, Delhi sores, etc.

#### Incidence of the disease in Delhi

The sore appears to have been present in Delhi at least since the time of Aurangzeb, for the Emperor himself has been recorded by the historians to have been suffering from a sore of a similar description. It is presumably on account of this that the oriental sore is popularly known in Delhi as the *Aurangzebi phora*. It is interesting that the very first observations on the parasite of this disease were made by Cunningham in Calcutta in 1885, from the examination of a patient from Delhi. Odd cases of the disease are seen almost every year, but in 1939-40 Delhi saw the outbreak of an epidemic which appears to have involved, on a modest estimate, 15,000 to 20,000 individuals in Karol Bagh alone.

The first information about the outbreak was received in June 1939 when Dr. H. C. Gupta, medical officer, Ramajas High School No. 2, reported the occurrence of multiple sores amongst the boys at the Ramajas School. As the sores were proving refractory to ordinary methods of treatment, he asked for help and advice regarding their management.

On visiting the school I learnt from the headmaster, that except for a suspicious ulcer which

he once observed in 1938 on the nose of a boy, Sham Saran, he had never seen such sores until the beginning of that year. He also mentioned that some of the dogs in that area were found to have a large number of sores during the previous winter and that he believed quite a number of these dogs eventually died of the disease. A general inspection of the boys showed that a large number were suffering from lesions characteristic of the oriental sore. As the line of treatment to be adopted was rather vague, it was decided to run parallel treatments and incidentally investigate, as far as possible, the origin of the epidemic. Observations were made as follows :—

*Features of the place.*—The school as well as the adjoining college are residential institutions, each with 300 to 350 boys on their rolls. Just beneath the school there is a colony of about 200 persons mainly consisting of the staff and their families.

Both the institutions are well-ventilated double-storied *pucca* buildings, and, except for a small section of the platform in front of the hostel, there was little evidence of any loose earth or masonry. The general sanitation of the place was, however, extremely unsatisfactory. Although latrines had been provided they were seldom used, the boys being in the habit of defecating in the open.

Both the school and the college are built on top of the 'Kala Pahar', an irregular rocky ridge near Sarai Rohilla. The country on the south-western side of this ridge is, for miles around, dry, barren and rocky. Between the ridge and Karol Bagh is a large tract of land which until 1938-39 was a big dumping place for the refuse of the adjoining localities and a great cesspool for the promiscuous drainage of Raigerpura and other neighbouring localities. It was, however, levelled up by the Improvement Trust in 1938 and since then, though still far from being sanitary, it has at least begun to look respectable.

#### Survey of the population

Originally attention was only confined to boys, but in December 1939 a survey of the entire population of the ridge was carried out. The various particulars about the sores in school boys were recorded on 'spot' diagrams while those of the colony were entered in a register. It was found that the college had 55, the school 123, and the colony, excluding 14 boys who were attending the school, 109 affected with the disease. The distribution of cases in the colony according to their age and sex is given in table I.

*Laboratory examination.*—A large number of sores were examined by Dr. H. R. Bhambi, in charge Irwin Hospital Laboratory. On account of the absence of a suitable incubator the cultural examinations did not prove very successful. The majority of the smears were

however readily found positive for leishmania bodies.

TABLE I

TOTAL POPULATION		AFFECTED			UNAFFECTED		
Age groups	Number	Male	Female	Total	Male	Female	Total
5	29	10	9	19	5	5	10
10	40	15	10	25	10	5	15
15	35	17	3	20	11	4	15
20	29	11	4	15	9	5	14
25	22	8	4	12	9	1	10
30	23	5	2	7	6	10	16
40	36	12	6	18	9	9	18
50	8	2	..	2	6	..	6
60	8	2	2	4	3	1	4
70	2	..	..	..	..	2	2
90	1	1	..	1	..	..	..
TOTAL	233	83	40	123	68	42	110

*Leishmin test.*—One c.cm. of leishmin diluted 1 in 10 with distilled water was given intradermally to each boy in the school. Results were read after 48 hours; it was found that 75 out of 76 boys affected with the disease and 140 out of 206 of the unaffected gave positive results. A control examination of the boys in the Reformatory School situated at a considerable distance from the affected area showed that 12 out of the 40 boys there were also positive.

*Inspection of the dogs.*—All the dogs (17 or 18) in the locality were examined. Two of these were found to have sores. One of these dogs becoming annoyed with the daily attempts to catch him left the locality, but the other which was caught was found to have five sores distributed as follows:—Two below the lower lip, one by the side of the nostril, one beside the outer canthus of eye, and one over the ear. Examination of these sores revealed the presence of leishmania bodies.

*Sand-flies.*—With the help of an assistant lent by the Imperial Entomologist, Delhi, attempts were made to catch sand-flies. These efforts did not prove successful until Dr. R. O. A. Smith, who came to Delhi in connection with the Research Workers' Conference, was requested to visit the school. Although it was mid-winter he easily caught a number of excellent specimens. These were subsequently reported by him as *P. sergenti*, heavily infected with the flagellate forms of *Leishmania tropica*.

*Treatment.*—Boys in the school were divided in batches and parallel treatment with the following were given:—

- (1) Antimony tartrate ointment, 2 to 4 per cent.
- (2) Protosil rubrum ointment, 5 per cent.
- (3) Sulphonamide 'P' ointment, 5 per cent.
- (4) 'Barber's' ointment.
- (5) Wheat-germ oil.
- (6) Herb satyanasi.
- (7) CO<sub>2</sub> snow.

- (8) Injections of sodium antimony tartrate.
- (9) Injections of leishmin.
- (10) Injections of berberine sulphate and orisol.
- (11) Injections of neostibosan.
- (12) Scraping.

On account of distance, the limited time available for the purpose, the interruptions of the autumn and Christmas vacation and the lack of a steady supply of drugs and dressings the experiment got rather confused, and it was not until 4th January that the question was taken up systematically. The treatment this time was given with strict regularity and the progress of each case was recorded in a register. Results noted on 29th January, 1940, are given in table II.

From table II it will be observed that by the end of January the majority of the sores were either partially or completely healed and those which did not show signs of improvement, began to do so after changing over to new lines of treatment. Seeing the encouraging results obtained in the school, other affected individuals in the same locality as well as those living in various parts of Karol Bagh began to clamour for a similar treatment. By this time it had become fairly obvious that a big epidemic was raging, not only over the ridge but in the whole of Karol Bagh including the neighbouring quarries at Jhandewala, where hundreds of labourers were suffering from the disease. Indeed, cases began to appear in Sadar Bazar, Sabzimandi, Pahar Gunj and the Imperial Agricultural Research Institute, and it looked as if the epidemic was going to involve the whole of Delhi and New Delhi areas. A report was accordingly made to the chief medical officer, Lieut.-Colonel R. E. D. MacGregor, with the recommendation that a special dispensary should be provided in the centre of Karol Bagh. As a result of his interest and encouragement, two private practitioners, three Government sub-assistant surgeons and a number of compounders from the various dispensaries volunteered for the work. The equipment having been brought from the Irwin Hospital, in a few days time a fully-fledged dispensary, the oriental sore dispensary, Karol Bagh, began to function from 5th February, 1940. The chief health officer, Lieut.-Colonel W. H. Crichton, took up the work of publicity and by distributing leaflets not only brought the dispensary to the public notice but also gave information about the various preventive measures against the disease. The dispensary, which was then working only for 2 hours in the afternoon, soon began to overflow, and before the end of March the daily attendance rose to 450. With the treatment not always being an injection but an ointment like that of the barber's, to not one or two sores but to dozens, all to be cleaned, dressed and bandaged, the controlling of such a large number of patients created a big problem. It was at this time that the present chief medical officer, Lieut.-Colonel M. M. Cruickshank, arrived and quickly sizing

TABLE II  
Showing results of treatment

Serial number	Treatment	PATIENTS WHO HAD NO PREVIOUS TREATMENT							PATIENTS WHO HAD PREVIOUSLY BEEN TREATED INEFFECTIVELY					Total number
		Treated	Average duration of sores, weeks	Average number of sores	Cured	Improved*	Uncured †	Absent on 29-1-40	Treated	Cured	Improved*	Uncured †	Absent on 29-1-40	
1	Scraping ..	16	9	5.11	14	1	1	..	19	14	5†	..	..	35
2	Sodium antimony tartrate injection.	10	10	24.07	0	8	2	..	11	..	8	1	2	21
3	Orisol injection ..	1	12	3	..	1	..	..	3	..	1	..	2	4
4	Neostibosan injection ..	1	4	36	..	1	..	..	4	..	4	..	..	5
5	Leishmin injection ..	10	10	16.87	1	6	2	1	6	1	1	2	2	16
6	Sulphonamide 'P' ointment	8	3	2	7	1	..	..	..	..	..	..	..	8
7	Tartar-emetie ointment, 4 per cent.	4	9	3.75	4	..	..	..	2	2	..	..	..	6
8	Barber's ointment ..	1	1	1	1	..	..	..	2	..	2	..	..	3
9	Prontosil rubrum ointment ..	4	4	2	4	..	..	..	..	..	..	..	..	4
10	Wheat-germ oil ..	2	2	1.25	..	..	2	..	6	..	..	6	..	8
11	Herb satyanasi ..	1	6	4	1	..	..	..	3	..	..	3	..	4
TOTAL ..		58	6.36	9.004	32	18	7	1	56	17	21	12	6	114

\* Healed under the same treatment.

† Healed subsequently under other treatments.

‡ Scrapped on 22nd January, 1940.



up the needs of the situation secured a whole-time and a more permanent staff for the dispensary.

With the extension of the epidemic areas even beyond Karol Bagh, it became obvious that further centres of treatment were needed. For this purpose the sub-assistant surgeons from the Willingdon Hospital, the Pusa Institute dispensary, and the Jama Masjid dispensary were given training at Karol Bagh and subsequently asked to start centres of treatment in their own localities. During 1940, about 1,150 cases at the Willingdon Hospital, 650 at the Jama Masjid dispensary and 150 cases at the Imperial Agricultural Research Institute were dealt with by these doctors. The Lady Hardinge and Tibbia College independently treated a large number of cases amongst their own out-patients, and the National Council of Women improvised arrangements on the spot for the treatment of women labourers in the quarries at Jhandewala. In addition a considerable number of the afflicted went to private practitioners and local *jarrahs* for their treatment. Although the main force of the epidemic appears to have subsided, a small number of fresh cases are still being seen.

The dispensary which has since been taken over by the Delhi Municipal Committee continues to function even now with an average of 80 cases attending daily. During the first four months of the rush, the dispensary was regularly visited by me every day, but from June 1940 the work has been practically carried out by Dr. S. K. Kohli and by Dr. A. P. Mitra, an honorary medical officer. From the start until the end of 1940, 4,215 cases, as detailed below, have been treated at the dispensary :—

	New cases	Old cases	Total
February	.. 1,147	3,608	4,755
March	.. 839	7,640	8,479
April	.. 507	5,113	5,620
May	.. 360	3,671	4,031
June	.. 169	2,769	2,938
July	.. 264	3,131	3,395
August	.. 265	3,489	3,754
September	.. 204	3,301	3,505
October	.. 162	2,998	3,160
November	.. 140	2,765	2,905
December	.. 158	3,163	3,321
<b>TOTAL</b>	<b>.. 4,215</b>	<b>41,648</b>	<b>45,863</b>

In view of the experience gained during the management of such a big epidemic observations on the following may be worth recording :—

1. *The origin of the epidemic.*—Because of the long incubation period of the disease extending in some cases to over 9 months or more, the various factors contributing towards the outbreak could not very well be investigated with

any degree of confidence. Efforts made in this direction, however, showed that

(i) Sand-flies collected from Ramjas College in the middle of December 1939 were identified by Dr. R. O. A. Smith as *P. sergenti* and were found infected with flagellate forms of leishmania. This apparently confirms the suggestion of Shortt, Sinton and Swaminath (1935) about this species, *P. sergenti*, being the vector in India.

(ii) Infected dogs were found in the school. The outbreak of the disease in the dogs which preceded the epidemic amongst the boys would however appear to show that the dogs may be the possible reservoirs of the infection, as suggested by Sinton and Shortt (1934). Excepting for the subsequent finding of infected dogs, the observation by the headmaster regarding the occurrence of the disease amongst dogs in its fatal form unfortunately missed scientific confirmation.

(iii) The two years preceding the epidemic were dry and deficient in rainfall. A similar observation was made in Quetta where there was practically no rain in the year before the epidemic.

(iv) The Quetta outbreak followed the earthquake of 1935. That the Delhi epidemic followed the large scale disturbance of the land by the Improvement Trust in 1938 would appear to be more than a chance occurrence. The relation of this disturbance to the origin of the epidemic is, however, not clear. The ready explanation in terms of the suitability of ground for the breeding of sand-flies would not be reasonable when nobody could say that sand-flies, which have always been quite common in Delhi, showed a particular increase in any of the years preceding the epidemic.

If excessive breeding of sand-flies had been responsible the more extensive levelling up of the ground in the Bela around Daryaganj, Kotla Ferozeshah, and Hardinge Avenue, going on at about the same time would have led to a similar outbreak of the disease in these localities as well. It may be noted that the Bela with its sandy soil and a greater degree of moisture is apparently more suited for the breeding of sand-flies than the altogether dry and rocky area of Karol Bagh.

The epidemic was found to be more intense particularly in Jhandewala and in the southern *bastees* of Ragherpura and Beadonpura. It spread to the adjoining localities of Sabzimandi, Sadar Bazar and Paharganj, but, although the neighbouring New Delhi was practically unaffected, the Imperial Agricultural Institute situated at about 2½ miles from Karol Bagh was rather heavily involved.

If the spread had been due to the simple question of sand-flies with the prevalent winds in Delhi being westerly and north-westerly the epidemic would have spread more extensively to

Sabzimandi on the north, rather than to the Imperial Agricultural Institute situated on the south-west. From May until the end of September easterly and southerly winds prevail but New Delhi lying in the direction of these winds was, however, left unscathed. A similar irregularity of spread in relation to the vicinity of the ruins was mentioned by Dr. R. O. A. Smith in his report on the Quetta outbreak. On account of the irregularity and because of there being no particular increase in the number of sand-flies, he attributed the origin of the Quetta epidemic to the overcrowding which followed the earthquake. As no overcrowding can be said to have occurred in Karol Bagh I am forced to the conclusion that any hypothesis based on the sand-fly theory would be inadequate in explaining its origin, at least in this area.

The transmission of the disease through the bites of sand-flies has been postulated on exceedingly plausible evidence, and one as a clinician naturally hesitates to say anything against the conclusions arrived at by various eminent epidemiologists. But in view of the repeated failure of different workers in transmitting the disease through the bites of the infected sand-flies the matter cannot be accepted as entirely closed. The following remarks are therefore put forward tentatively :—

(a) The distribution of the sores in the majority of cases was observed to be, as is usually the case, on the exposed parts of the body. A small number of cases were however seen with sores on parts which are generally kept covered and thus protected against the bites of sand-flies. Although the possibility of exposure in these cases could not be excluded, the finding of sores over the nipple of a female patient, over the genitals of a boy and on the umbilicus of an infant indicated some mode of infection other than the bites of some insect vector.

(b) It is common knowledge that mosquitoes rarely bite over the lips and the nose. Oriental sores were frequently seen to occur over these parts and often enough as solitary sores which could not have resulted from any auto-inoculation. One would have thought that the movement of the in- and out-going air we breathe would be strong enough to prevent the sand-flies comfortably sitting and biting over these parts, which are even respected by sturdier and bigger insects like mosquitoes.

(c) The dogs observed by me at the Ramjas School showed sores only on the face. From the previously recorded observations on the dogs it would also appear that the face is the usual site of the disease in these animals. Although sores have been seen on the legs in a few cases the body has never been reported as being ever affected by the disease.

It is strange that the insect vector should spare the canine body which is equally exposed to its bites.

(d) As the inhabitants of Karol Bagh chiefly belong to the lower middle and poor classes, the bulk of cases were naturally supplied by them. It however did seem to appear that the poorer people and the labourers were comparatively more commonly affected by the disease than the better class people living in the same area.

If the infection takes place through the bites of the sand-flies, why do the exposed parts receive particular attention in the case of labourers?

From this brief discussion it will be seen that many points regarding the epidemiology of the disease still remain obscure. The theory of transmission by the sand-fly does not appear to cover all the observed facts. Hence the possibility of other modes of transmission should not be ignored.

Being one mainly interested in the clinical aspects of the problem I am fully aware of my limitations. But I cannot help suggesting that the question requires approach from a wider standpoint than that of the sand-fly. In the allied infection of kala-azar, the possibility of its spread through the faeces has been seriously considered. Both to kala-azar and oriental sore man and dog are equally susceptible and the close association that exists between the two presents many possibilities for the transference of infection. I am not aware of any study demonstrating the presence of *L. tropica* in the faeces of human beings or dogs. The strictly local nature of the manifestation of this disease perhaps militates against the generalized prevalence of the infection in the body and the consequent possibility of the organism being excreted in the faeces. Nevertheless, it may be useful to investigate whether the organism is present in the faeces of dogs and men suffering from oriental sore. If so, a study of the viability of the organism in nature and of the possibility of its inoculation into minute abrasions in the skin through infected dust may prove useful.

It will be remembered that the disease is particularly prevalent in the dry areas of the Middle East, Southern Russia and North-western India, a wide stretch of territory where low rainfall and high temperature tend to create a high concentration of dust in the atmosphere. If infected dust, the irritation it causes, and the consequent scratching of the affected part by the individual do play a part in the spread of oriental sore, then the possibility of the occurrence of the sore in the usually unexposed parts of the body becomes clear, as also the frequency of the disease amongst the labourers, and the limitations of the affection in dogs to the face.

It is recognized that not even the shadow of any proof has been advanced for this theory and that, in consequence, it will hardly receive any serious consideration. But if some research worker, who has the requisite facilities for such a study, is perhaps tempted to undertake a

re-examination of the whole problem of transmission my purpose will have been amply served\*.

*Intensity of the epidemic.*—Karol Bagh is inhabited chiefly by the lower middle and poor class people. In this area there was hardly a family which did not reveal at least two or three cases of the disease. It has a population of about 50,000 people. Taking into consideration the large number of individuals infected in the adjoining localities, it will not be too much to say that more than 20,000 individuals suffered from the disease during 1939-40.

With regard to the severity of the disease it has not been possible to give comparative figures, but it was evident that cases with all degrees of severity were present. A labourer in the quarries at Jhandewala was recently found by Dr. Mitra and myself with not only 239 active sores on his body, but also with innumerable scars of the lesions which had healed.

*Clinical features.*—During the epidemic it was observed that the pattern of sores was so varied that the classification proposed by Varma (1927) into types I to IV as papule, scab, ulcer, septic sore did not satisfactorily convey the true impression about the variety of the sores. Varma's classification being more descriptive of the evolutionary state of the sores,

\*[Note.—Major Shah's article on oriental sore is in our opinion the most valuable contribution, on all aspects of the subject, that has been made for some time. However, we feel that we must comment on his discussion on the transmission problem.

We admit that the proof of the sand-fly transmission is not 'cast iron', but the evidence is so strong that a much better case against it, than that put forward by Major Shah, will be necessary before any extensive *de novo* re-examination could be recommended.

(a) He admits that the vast majority of the bites were on the exposed parts of the body. A few exceptions are not of importance, and certainly not the ones he quotes; the opportunities at night for a sand-fly to bite the umbilicus of an infant and the genitals of a boy, not to mention the nipples of a female, are considerable, and the last-named might easily have been infected from a suckling infant.

(b) and (c) We do not agree that mosquitoes and sand-flies seldom bite the nose or lips of man, and, as far as dogs are concerned, we believe it is the site of choice; the skin is much thinner and very vascular here, and there is little or no hair. This is in fact a strong point in favour of the sand-fly transmission.

(d) The points here seem to us self contradictory, or perhaps we have failed to grasp them.

Major Shah's hypothesis, that the leishmania may be excreted in the stools of man and/or dogs and transmitted in dry dust, takes one right back to the earliest days of the kala-azar investigations. There is little evidence that *Leishmania tropica* infection ever becomes generalized, in man at least, and none that it infects the intestinal mucosa, as it may in kala-azar. No resistant form of leishmania has been established and from a protozoological point of view the probabilities of the existence of such a form that would resist considerable drying seem remote.

However Major Shah gives his hypothesis for what it is worth and makes no claims.

An important observation in connection with the sand-fly hypothesis, which we feel should have been accorded separate publication, is reported here, namely, Dr. R. O. A. Smith's findings of leishmania-infected sand-flies in nature. The author gives full credit to Dr. Smith (L. E. N., Editor, I. M. G.)]

rather than of their particular variety, the following classification was adopted at the dispensary:—

A. General types:—

1. Papules:
  - (a) Small.
  - (b) Fleshy.
  - (c) Exudative.
2. Scabs:
  - (a) Dry.
  - (b) Septic.
  - (c) Exudative.
3. Ulcers:
  - (a) Clean.
  - (b) Septic.
  - (c) Exudative.

B. Special types:—

4. Eczematous:
  - (a) Primary.
  - (b) Secondary.
5. Lupoid.
6. Fungating.

C. Complication:—

1. Lymphatic spread.
2. Phlebitis.
3. Generalized dissemination.

Of these types nearly all have previously been recognized, but the exudative forms do not appear to have been described. Unlike the other varieties they show a good deal of reactionary redness and swelling, which led to their being originally described by me as allergic. The erythematous and oedematous character of the sores does not appear to be due to secondary infection, at least to any extent, as this feature is present even in sores whose surface is unbroken, and those which are ulcerated lack the usual type of discharge present in the septic sores. Exudatives occur more commonly amongst the children and adults of a phlegmatic disposition. They are most difficult to manage and under local treatment have a great tendency to a lymphatic spread. This is especially apt to occur when irritating ointments are used in the treatment of this type.

Generalized dissemination as a complication has been illustrated. Quite a few cases of this type have been seen. The lesions are papular and reminiscent of a chronic urticarial state, but there is seldom any itching. As *Leishmania tropica* has not been observed in the smears of the few cases examined, one cannot really say if they are directly due to the infection by *Leishmania tropica*.

*Diagnosis.*—Clinically the general appearance of the sores, in the majority of cases, was quite characteristic of the disease. There were, however, various types of lupus cases which occasionally presented some degree of difficulty, but the oriental sore invariably showed the characteristic scaling on its surface.

Cultural examination did not prove a ready help until the proper incubator was received and Dr. Bhambi began to work with the original N.N.N. medium rather than its modifications which were being previously tried. Smears were often found to be quite dependable. On account of the varying shapes and sizes of the

parasites and the consequent difficulty in the recognition of the macro- and micro-nuclei, discrete bodies, particularly when lying free, are often difficult to make out from the particles of stain and the blood platelets. Even on a single examination of the smear, however, it was generally possible to find endothelial cells riddled with the organisms. Positive results in almost 7 out of 10 cases were often obtained. A similar proportion of positive findings was also reported by the provincial laboratory.

A high percentage of positive reactors was found amongst the affected boys of the Ramjas but the subsequent finding of 32 per cent of positive reactors, even amongst the boys of the Reformatory School, showed that the intra-dermal test with leishmin is, if of any, only of a negative value.

### Treatment

Although records of all cases treated at the dispensary have been kept in the form of treatment cards, the big rush of patients, frequent changes in the medicines, the irregular attendance have all combined to cripple their statistical value.

After excluding the 1,883 defaulters who failed to attend beyond a week the 2,332 cases which continued to attend the dispensary various treatments were given as follows :—

1. Local applications .. .. .	1,382
2. Scraping .. .. .	285
3. Injections of berberine sulphate and orisol ..	155
4. Injections of antimony compounds ..	453
5. Injections of leishmin .. .. .	43
6. Local injections of sulphonamide ..	15

The treatment was carried out according to the following scheme :—

#### A. Papule:—

- (1) Small—berberine sulphate followed, if necessary by the application of tartar-emetic (TE) ointment.
- (2) Fleishy—TE ointment after an initial scratching of the surface. Applications continued daily till necrosed.
- (3) Exudative—injections of antimony compounds.

#### B. Scabs:—

- (1) Dry—scraped.
- (2) Septic—TE ointment till necrosis.
- (3) Exudative—antimony injection.

#### C. Ulcer:—

- (1) Clean—4 or 5 applications of TE ointment.
- (2) Septic—ditto.
- (3) Exudative—antimony injections.

#### D. Fungating:—Scrape.

#### E. Lupoid:—Antimony injections.

#### F. Eczematous:—Ditto.

#### G. Lymphatic:—Ditto.

Injections of antimony tartrate were generally preferred in cases with a larger number of sores and with sores on the face, particularly if of the exudative, eczematous, lupoid and lymphatic types. Scraping was generally avoided in the exudative type of sores and in sores on the face, but was done in all those with a dry and fungating type of sore, provided the patient was agreeable to this form of treatment.

Tartar-emetic ointment was employed in cases which were not considered suitable for either scraping or the injections of antimony compounds. Papules were often submitted to the berberine sulphate injections.

#### Details of treatment:—

##### 1. Local applications:—

1. Tartar-emetic ointment, 4 per cent.
2. Sulphonamide 'P' ointment, 5 per cent.
3. Callot's fluid.
4. Boric ointment.
5. Zinc ointment.
6. Silver nitrate.
7. Carbolic acid.
8. Nitric acid.
9. Barber's ointment.
10. Magnesium sulphate paste.

Most of the cases in this group were treated either from the first, or subsequent to the failure of other applications, with tartar-emetic ointment. Barber's ointment was employed only sparingly as it generally gave severe reactions. Of the other applications sulphonamides gave a hopeful impression, but it was soon found that the beneficial effect was only in some of the dry and septic sores.

##### I. Tartar-emetic ointment (4 per cent antimony tartrate in vaseline)

As a result of the initial experience gained at the Ramjas School, the strength was deliberately increased to 4 per cent as the conventional 2 per cent had been found to be too slow and uncertain in its action. The strong ointment often causes a marked local reaction but the resulting inflammation is seldom severe. Ointment was generally applied daily until the sores became thoroughly necrosed. This was usually evident from the appearance of a line of demarcation between the necrosed tissues and the surrounding healthy skin. When this became obvious, hot poultices were applied until the inflammation subsided, when applications of magnesium sulphate paste or boric ointment only were made. As the ointment was apt to make the surrounding skin sodden and ulcerated at several points, it was successfully protected by a thick covering of the zinc ointment.

(a) Barber's ointment.—The formula as revealed by Jarrah Abdur Rashid was as follows :—

Arsenic .. .. .	1 ounce
Catechu .. .. .	4 drachms
Hard paraffin .. .. .	1 ounce
Butter .. .. .	4 ounces

Application was made daily on a piece of lint. At the end of 4 to 5 days hot poultices were applied until a clean granulating surface was obtained, when daily dressings with some simple ointment, such as zinc or boric, were applied.

##### II. Injections of antimony compounds

The majority of the cases in this group were treated with intravenous injections of sodium antimony tartrate.

A solution of the sodium antimony tartrate was made up daily in the strength of 1 grain

to 2 c.cm. of distilled water. After an initial injection of 1 c.cm. subsequent doses of 2 c.cm. were given twice weekly to all adults, until the sores dried up completely or a total dosage of 18 grains had been given. Cure was generally observed before the maximum dose was reached. During the course of injections local dressings were avoided unless a particular sore was found to be septic, when it was dressed with glycerine magnesium sulphate paste. In all other cases it was recommended that the sores be kept clean with oil or left alone.

*Side effects.*—These were rarely serious, but now and again patients who failed to show quick improvement demanded a change to other treatment.

These effects were:

1. Local inflammation at the site of injection from leakages.
2. Coughing and vomiting.
3. Febrile reactions.
4. Fleeting joint pains.
5. Sudamina-like rash over the body.

Children were generally treated with intramuscular injections of anthiomoline, a May and Baker product which gave equally good results, and indeed, on account of the freedom from bouts of coughing, vomiting and febrile reactions after this drug, it was often advised to well-to-do adults, who could afford to buy it.

### III. Scraping

Volkman's spoon was freely used, usually without any anæsthesia. The base as well as the edges of the sore were thoroughly scraped until the fibrous layer was reached.

Generally, only 3 to 4 sores were treated at each sitting. The resulting wounds were cleaned with ether and dressed with plenty of tannic acid powder. Usually on the fourth day after the scraping, dressings were removed, if possible, with liquid paraffin. The use of paraffin permitted the scab formed by the tannic acid to remain intact and thus obviated the need for subsequent dressing, the sore generally healing by itself under this scab. In the majority of cases aseptic necrosis of the scraped area however led to a good deal of discharge which necessitated cleaning the surface, and in these cases daily dressings with magnesium sulphate paste were applied to the ulcer until it healed. Lately, occlusive dressings with coal tar have been employed with still better results.

### IV. Injections with berberine sulphate

Orisol, an M. and B. product, or alternatively with 2 per cent solution of acid berberine sulphate were used for local infiltration. Two to three injections were made to each sore using a maximum of 4 to 5 c.cm. for the full treatment of the sores at any one sitting. This process was repeated once weekly. If the response was lacking after 2 to 3 injections, the treatment was discontinued, as it was found that cases which failed to improve after this number seldom healed under prolonged treatment.

### Results

As a result of the preliminary trials with the various medicines, it was found that the secret of successful treatment lay in the recognition of the particular type of sores and the choice of corresponding medicines for their management. A number of drugs like sulphonamide gave high hopes, but after more extensive trials it was found that they were really quite inadequate. The sores which yielded to such medicines were generally either the dry type which readily heal up under the mildest help or the septic sores in which the specific infection appeared to have been largely overcome by the secondary invaders. In such sores it appeared to be more a matter of keeping them clean and giving a chance of proper healing.

The general efficacy of the local applications has been considered to be finally dependent upon their ability to induce local necrosis, thus leading to the destruction of infection by physical means rather than by specific action of the medicines.

Of the local treatments, it was found that scraping was the best measure against the sores, provided they were not of the exudative type or extensive patches of the lupoid and eczematous types. Under this treatment the sores generally healed up within two to three weeks, and, excepting for a few cases which had probably been ineffectively scraped, never showed any relapses.

Of the local applications, barber's ointment and 4 per cent tartar-emetic ointment were the only preparations which appeared to be reliable. Barber's ointment was, however, found to give more severe reactions and consequently its use had to be limited to only a few cases.

Four per cent tartar-emetic ointment gave fairly good results. An average case required 8 to 10 applications, when healing followed in 4 to 6 weeks under zinc or boric ointment. A few cases apparently became resistant, and required scrubbing of the surface, in order to achieve a quicker effect.

Berberine sulphate infiltrations were generally unreliable. In a few cases the papules dried up after 2 to 3 injections or formed into ulcers which subsequently healed under the application of simple ointments, but in the majority of cases, they did not appear to have any favourable influence over the sores.

Applications of carbolic and nitric acids were found to be too superficial in their action, as the papules to which they were applied often reappeared after the healing of their cauterized surface.

Injections of the antimony compounds appeared to act in a specific manner, as the lesions healed by progressively getting drier, until they disappeared leaving a smooth pigmented surface behind. Their use however was resented by those who had only a few sores and was also considered to be too severe a line of treatment, where only a few simple papules or

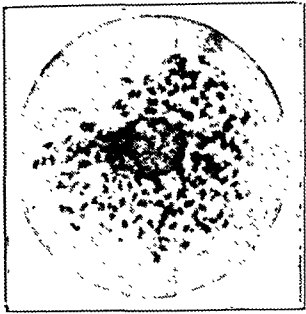


Fig. 1.—*Leishmania tropica* in an endothelial cell.



Fig. 2.—Eczematous sore—nipple.



Fig. 3.—Small scab—nose and diffused sore—lower lip.

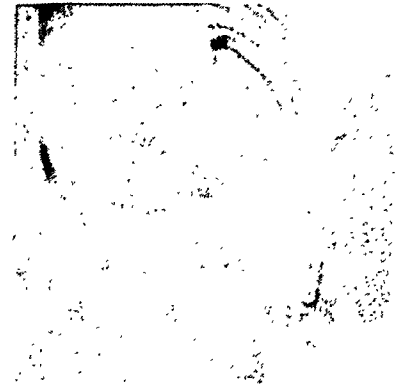


Fig. 4.—Exudative papule—elbo



Fig. 5.—Eczematous sore—umbilicus.



Fig. 6.—Legs of a case with 239 sores.



Fig. 7.—Fleshy papule.



Fig. 8.—Ulcerating fleshy papu after tartar-emetic ointmen



Fig. 9.—Exudative scab—elbow.

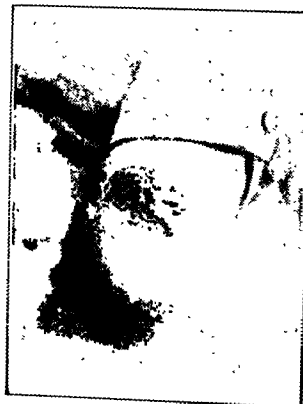


Fig. 10.—Exudative ulcer.



Fig. 11.—Dry scab.



Fig. 12.—Clean ulcer.





Fig. 13.—Fungating sore.



Fig. 14.—Fungating sore with eczematous areola.

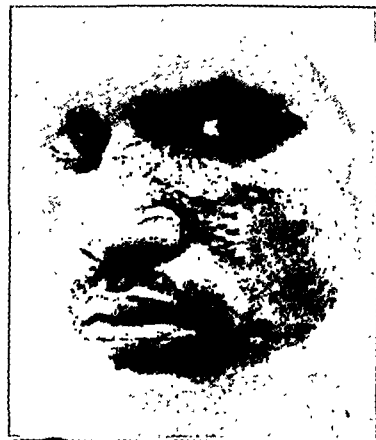


Fig. 15.—Lupoid type.



Fig. 16.—Disseminated type.



Fig. 17.—Eczematous type with lymphoid spread.



Fig. 18.—Septic ulcer.

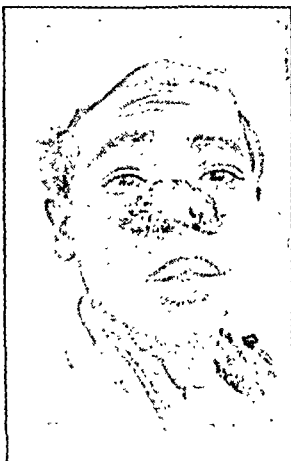


Fig. 20.—Fungating sore peeling off under antimony injections.



Fig. 21.—Line of demarcation after tartar-emetic ointment.



Fig. 23.—Clean granulations—tenth day after scraping.

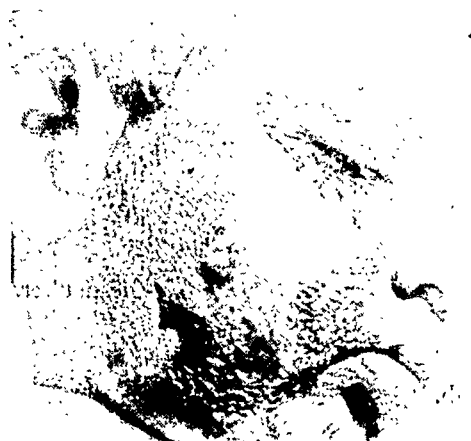


Fig. 22.—Secondary eczema following tartar-emetic ointment to fleshy papule.



Fig. 19.—Exudative ulcer of fingers with lymphatic spread.

ordinary scabs and ulcers were involved. Further it was found that a few cases without showing much of a response began to show signs of intolerance and even after very great persuasion failed to continue the injections of these compounds.

The vast majority of the patients who persisted with the course generally healed in 6 to 8 weeks.

#### Summary

1. An epidemic involving nearly 20,000 individuals in Delhi has been described.
2. A few observations have been made regarding the mode of transmission.
3. A description of the exudative types of oriental sore has been given.
4. A new classification for the various types of sores has been proposed.
5. Scraping has been found to be the treatment of choice provided the sores are of a suitable type.
6. The curative action of the tartar-emetic ointment has been considered to be due to its necrogenic properties rather than the results of any specific effect. The strength of the ointment has been recommended to be increased to 4 per cent for achieving quicker and more certain results.
7. Injection therapy with the trivalent and pentavalent antimony compounds has been found to be the only possible 'specific' for the disease.

#### Acknowledgments

I am obliged to Dr. H. C. Gupta, medical officer, Ramjas High School, and Mr. R. S. Gupta, the headmaster, for supplying the necessary information about the epidemic and for generally assisting me at the school.

My thanks are due to Dr. Bhambi, medical officer, in charge Irwin Hospital laboratory, for doing the bulk of the laboratory investigations and for assisting me in the surgery and treatment of cases at the Ramjas School, and to Dr. R. O. A. Smith for reporting on the sand-flies and for giving me some excellent suggestions.

I am indebted to a large number of other doctors who came forward to help; of these particular mention must be made of Dr. S. K. Kohli who after working honorarily for several months subsequently agreed to give his whole-time services to the dispensary on a nominal remuneration and to Dr. A. P. Mitra who ever since the inception of the dispensary has continued to give two hours of his valuable time every afternoon. I am also obliged to Dr. J. C. Ray of the Biological Laboratories, Calcutta, for the generous supply of leishmin and to Abdur Rashid Jarrah who generously supplied me with the formula of his ointment.

I am grateful to Lieut.-Colonel Crichton, the chief health officer, for placing the services of

(Continued at foot of next column)

## SULPHONAMIDE, SULPHATES AND ORDINARY DIET

### A CLINICAL INVESTIGATION INTO THE EFFECTS OF THEIR SIMULTANEOUS ADMINISTRATION

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IN 1936 the publication of the work of Colebrook and Kenny and others on the action of prontosil caused the English-speaking medical world to adopt the new chemotherapy with enthusiasm. That this enthusiasm was sometimes untempered by caution can be judged by the large number of reports published in 1937 describing toxic complications following the use of sulphonamide\*.

Among these complications sulphæmoglobinæmia figured prominently though not the most frequently; that it is still most readily brought to mind may be due to two factors. The first is the mistaken idea (which dies hard) that cyanosis indicates sulphæmoglobinæmia, and the second is that the restrictions that have been

\*The term sulphonamide is used generically for purposes of simplification in this article.

(Continued from previous column)

Dr. Pershad, his anti-malaria officer, at my disposal for assistance during the rush of the earlier months.

I need hardly add that but for the personal interest and encouragement from my successive chiefs, Lieut.-Colonel R. F. D. MacGregor and Lieut.-Colonel M. M. Cruickshank, such results as have been achieved would not have been possible.

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recommended regarding diet and drugs exert a popular appeal to doctors, nurses and even patients. Nor is this surprising, as the majority of writers on the subject of sulphonamide seldom fail to mention that patients must not be given sulphur-containing compounds, especially the saline purgatives, and eggs and onions must be excluded from the diet. One writer has even gone the length of issuing a warning against the use of hypodermic injections of the sulphates of atropine and morphia while sulphonamide is being exhibited.

Lately, however, a few dissentient voices have been heard deploring the prohibition of such valuable remedies as the sulphates and such an important dietetic article as eggs. Smith (1940) gave thirty cases pentothal sodium (which contains 12 per cent sulphur) although they were receiving sulphapyridine at the same time, and noted no untoward results. One case actually received no less than 3 grains of sulphur in this way while receiving intravenous sulphapyridine. He also states that he gives saline purgatives to cerebral cases receiving sulphonamides whenever indicated and has seen no complications.

Tisdall (1940) has published the sulphur content of various foods, which may be tabulated as follows:—

TABLE I  
Sulphur content of foods (after Tisdall)

Foodstuff	Sulphur content in parts per million
Boiled onions .. ..	23
Cauliflower .. ..	29
Boiled Brussels sprouts .. ..	77
White flour .. ..	108
Wholemeal flour .. ..	123
Eggs .. ..	170
Cheddar cheese .. ..	230

While admitting that eggs do contain a fairly high proportion of sulphur, Tisdall argues that the amount of sulphur ingested in 24 hours by an invalid through eggs and through bread would not be materially different.

On the other hand, Campbell and Morgan (1939) were able to produce sulphæmoglobinæmia experimentally by giving 3 grammes of sulphonamide and 4 grammes of confection of sulphur to individuals for two days. Sulphur in uncombined form was therefore not used in the series to be described.

#### Plan of investigation

The object of this investigation was to observe the effect, if any, of combining the administration of sulphonamide with therapeutic doses of sulphates and standard hospital diets.

One hundred cases were taken without selection, and, apart from about fifteen cases which had to be discarded for reasons not relevant to the investigation, they were consecutive. Sixty-one cases were young adult males because of the type of hospital accommodation available.

Every opportunity, however small, was taken to administer drugs containing sulphates, but excessive dosage was avoided.

#### Method of administration

(a) *Sulphonamide*.—Thirty-two cases received an initial dose of 2 grammes of 'M. & B. 693' by mouth followed by a further 2 grammes after 4 hours. Thereafter 1 gramme was given 4 hourly night and day until 16 to 20 grammes had been given. Forty-seven cases received 1 gramme of various sulphonamide preparations, either orally or by injection, three times a day until between 9 and 24 grammes had been given. Children received doses proportionate to their age.

(b) *Sulphates*.—These were given in the following forms, and many cases received more than one form:—

	Dose.
Saturated solution of sodium and magnesium sulphate ..	$\frac{1}{2}$ to 1 oz.
Mistura alba* ..	$\frac{1}{2}$ to 2 oz.
Mistura ferri aperiens* ..	$\frac{1}{2}$ to 1 oz.
Mistura quininae sulphata ..	$\frac{1}{2}$ to 1 oz.
Pulv. ipecac. co. ..	10 gr.
Atropine sulphate (injection)	100 to $\frac{1}{4}$ gr.
Morphine sulphate ( " )	$\frac{1}{8}$ to $\frac{1}{4}$ gr.
Hyoscine co.* ( " )	
containing atropine sulphate ..	$\frac{1}{16}$ gr.

\* For formulæ see Presidency General Hospital Pharmacopœia, the Extra Pharmacopœia Vol. I, Thompson's Compendium, etc.

(c) *Diet*.—The majority of cases were at first given a 'milk diet', which includes 2 eggs daily (the eggs average  $\frac{3}{4}$  oz. each). They then progressed to higher diets containing 2 eggs on alternate days. Onions are a favourite ingredient and flavouring medium in these diets.

#### Results

No case of sulphæmoglobinæmia was observed. Cyanosis was observed in two cases of pneumonia, and in one of acute pleurisy. The cyanosis was unaffected by the administration both of methylene blue as recommended by Wendel (1939) and of glucose intravenously as recommended by Brooks (1940). No abnormal spectroscopic bands were observed in the blood. It was therefore concluded that neither methæmoglobinæmia nor sulphæmoglobinæmia were present in these cases.

*Case 1*.—G. M., male, aged 67 years. Past history of treatment in hospital for heart failure. Admitted on 17th January, 1941, with bilateral bronchopneumonia of 48 hours' duration. Slight cyanosis present on admission. Treatment included M. & B. 693 2 grammes and then 1 gramme four-hourly. Dover's powder 10 grains on 17th and mistura alba 1 oz. on morning of 18th. Marked cyanosis noted on morning of 19th. M. & B. 693 discontinued. Died on 21st January of cardiac failure.

*Case 2*.—E. F., male, aged 19 years. Admitted on 9th December, 1940, with history of fever, pain in the chest and rusty expectoration for three days.

TABLE II  
Analysis of cases, showing types of sulphates given \*

Type of cases	SULPHATES GIVEN DURING SULPHONAMIDE THERAPY							Totals
	S. S. Sod. et Mag. Sulph.			Mist. Alba		Mist. Quin.	Mist. Ferri aperiens	
	$\frac{1}{4}$ oz. 4-hourly	$\frac{1}{4}$ oz. daily	Less than $\frac{1}{4}$ oz. daily	1 oz. daily	Less daily	1 oz. t.d.s.	1 oz. t.d.s.	
Septic surgical conditions ..	..	10	7	8	4	..	3	32
Infected operation wounds ..	..	4	..	..	..	..	..	4
Sepsis associated with filariasis ..	..	1	2	6	2	..	..	11
Ear, nose and throat conditions ..	..	8	8	3	..	..	..	19
Gonorrhoea ..	..	2	7	1	..	..	..	10
Malaria ..	..	..	..	..	..	6	..	6
Respiratory diseases ..	..	3	..	3	7	..	..	13
Sepsis coincident with other medical conditions.	1	..	..	..	2	..	2	5
	1	28	24	21	15	6	5	100

Examination revealed right lobar pneumonia. Treatment included M. & B. 693 2 : 2 : 1 : 1 grammes four-hourly, and then  $\frac{1}{4}$  gramme, *t.d.s.*, until 13th December. Mistura alba 1 oz. every morning. On 15th December he developed a fresh patch in the left upper lobe and M. & B. 693  $\frac{1}{2}$  gramme, *t.d.s.*, and mistura alba 1 oz. every morning were again given.

Cyanosis was observed on 16th December, and M. & B. 693 was discontinued. The cyanosis persisted for five days. Recovery. Discharged on 18th January, 1941.

Case 3.—J. F., male, aged 36 years. Admitted on 21st March, 1941, complaining of fever and pain in the chest for eight hours. Examination revealed acute fibrinous pleurisy on the left side, but an effusion rapidly formed later. Treatment included M. & B. 693 2 : 2 : 1 : 1 : 1, etc., grammes four-hourly until 20 grammes had been given. Saturated solution of sodium and magnesium sulphate  $\frac{1}{4}$  oz. every morning while receiving M. & B. 693. Mild cyanosis appeared after the fourth day, taking about ten days to subside. Recovery. Discharged on 14th April, 1941.

Six cases were given quinine sulphate by mouth simultaneously with sulphonamide. They all suffered from vomiting and their speed of recovery was noticeably slower than the expected speed. With the exception of these cases, the administration of sulphates simultaneously with sulphonamide had no adverse effect upon progress or speed of recovery, and no toxic phenomena (other than the cyanosis already recorded) were observed.

#### Conclusions

(1) Experience with 100 cases leads to the conclusion that patients receiving sulphonamide need not be subjected to special dietary restrictions.

(2) They may also be given sulphates in therapeutic doses provided proper care is exercised.

(3) If cyanosis occurs, sulphonamide should be discontinued until its cause has been determined.

(4) As there are alternatives to oral administration of quinine sulphate, this drug should not be used at the same time as sulphonamide.

Permission to publish this series of cases is kindly given by Major J. C. Drummond, I.M.S., Surgeon Superintendent, Presidency General Hospital, Calcutta.

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#### TOXAEMIA OF PREGNANCY\*

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TOXAEMIA of pregnancy is such a vast and important subject that it would be impossible for anybody to do justice to it in a short period like this. I shall therefore confine myself, as far as possible, strictly to the clinical aspects. The importance of the subject is shown by the two figures (1 and 2), one English figures and the other Calcutta figures; both of them show practically identical percentages of maternal mortality from toxæmia of pregnancy, which stands second in order of importance in both countries. No attempt on our part, either in the form of a laboratory study, clinical investigation or a statistical analysis, would be

\* Paper read under the joint auspices of the Bengal Obstetric and Gynaecological Society and Calcutta Medical Club, March 1941.

too much for the toxæmia of pregnancy considering the grave prognosis and the enormous mortality.

Toxæmia of pregnancy comprises a group of abnormal conditions of pregnancy. Unfortunately no toxin has as yet been isolated from

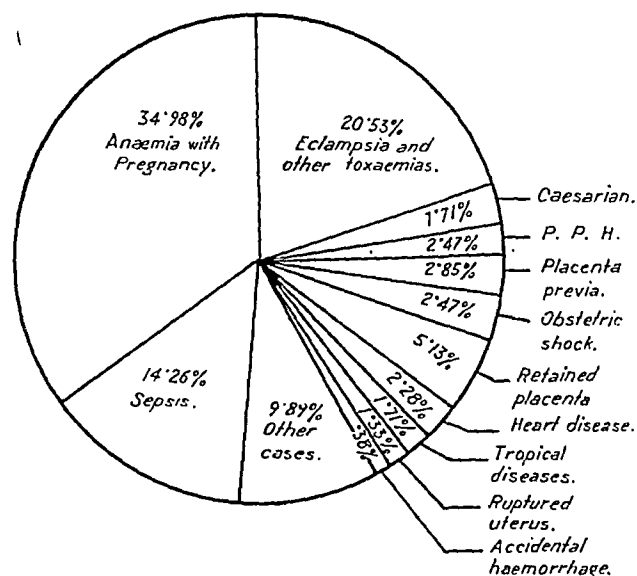


Fig. 1.—Incidence of mortality in different obstetric conditions (Chittaranjan Seva Sadan).

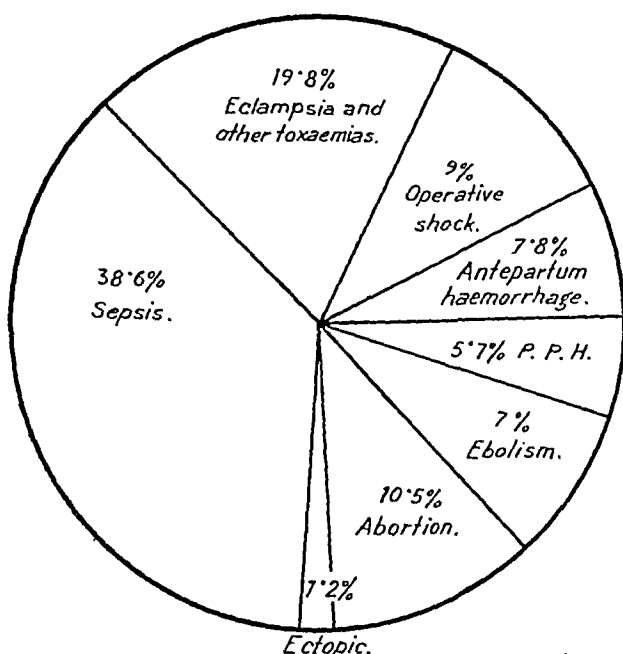


Fig. 2.—Incidence of mortality in different obstetric conditions (from 'Interim Report of the Departmental Committee, Maternal Mortality and Morbidity', 1930).

any of these groups and the modern conception is not exactly so much in favour of the toxæmic theory. Whether it is toxæmic or allergic or due to endocrine imbalance, the fact remains that these complex conditions take a heavy toll of our women in the prime of life and make many more disabled and invalid.

Although toxæmia of pregnancy has been differently classified by different investigators, the following classification appears to me a practical one:—

In early pregnancy (1) hyperemesis gravidarum;

In late pregnancy (2) essential hypertension in pregnancy, (3) nephritic toxæmia, (4) pre-eclamptic toxæmia, (5) eclampsia, and (6) acute yellow atrophy of the liver.

The term 'nephrosis' according to Stander (1929) serves no useful purpose in classifying toxæmia of pregnancy. By it is understood a mild degenerative tubular process with œdema but without hypertension. According to Stander, it serves only to cloak our ignorance and obscure still further our knowledge. In short, 'low reserve kidney', 'kidney of pregnancy', 'recurrent pregnancy toxæmia', 'albuminuria of pregnancy', 'occult nephritis', and some form of 'nephrosis' can be put under pre-eclamptic toxæmia. Concealed accidental hæmorrhage has not been classified separately as it has been considered to be one of the manifestations of pre-eclamptic toxæmia.

#### *Hyperemesis gravidarum*

Perhaps all patients with vomiting of pregnancy are neurotic to start with. Many investigators go so far as to assert that the only relation which hyperemesis has to toxæmia is the fact that both occur in pregnant women. The changes in the blood and urine chemistry, the histopathological changes in the liver and the ketosis are not peculiar to hyperemesis but are the inevitable result of vomiting, dehydration and starvation. The high ammonia coefficient of the urine which was at one time thought to be a grave toxic manifestation has ultimately been found to be the effect of starvation; so also the central degeneration of the liver cells, which was considered a characteristic landmark of toxæmia in hyperemesis gravidarum, is found to be the result of vomiting and starvation.

It is less important to decide whether it is neurosis or toxicosis as the root cause, than to find a proper remedy of this disease. The death rate in some places is about 6.8 per cent of the whole maternal death-rate of the hospital\*.

The management of a case of hyperemesis gravidarum should from the beginning be *energetic, systematic, and adequate*. I qualify the treatment with these trio with a definite purpose. Whether one believes or not in the theory of 'anxiety-neurosis', it has been definitely shown by Munro Kerr and others that the *energetic* isolation of the patient to some institutions with complete physical and mental rest reduces the death-rate to a negligible factor, provided of course she is transferred before sickness becomes intractable. The *systematic* treatment consists in the maintenance of water balance and of

\* Glasgow Royal Maternity Hospital (1926-30) (McIlroy, 1936).

carbohydrate metabolism. Lastly, I put great stress on the *adequate* treatment, because on most occasions the patient suffers from dehydration and starvation. Unless a sufficient amount of saline and glucose is given to replace the fluid loss and to supply sufficient calories for the maintenance of basal metabolic functions, the treatment will be an utter failure. Thus, to give a practical shape to the line of treatment it should be arranged as follows:—

(1) Immediately a case is diagnosed as one of hyperemesis gravidarum—the patient should be sent to a hospital or a nursing-home or completely isolated in a quiet room of the house, where there should be no admission for sympathetic friends and relatives. The nurse in attendance must be strict, quiet and not without courtesy.

(2) No solid food to be given by mouth for the first 24 to 48 hours. She may have occasional sips of water, fruit juice, and lemonade.

(3) A saline enema is to be given to wash out the lower bowel.

(4) Normal saline with 10 per cent glucose to be administered per rectum by drip method.

(5) About 50 c.cm. of 25 per cent glucose solution is given twice daily intravenously. In more severe cases the quantity may be increased to 100 c.cm. each time. In such circumstances, the intravenous glucose is best given by a continuous method by inserting the cannula into the saphenous vein over the ankle-joint and letting in 10 per cent glucose in normal saline by the drip method to the extent of about 10 pints in 48 hours and not exceeding 30 drops per minute. This appears to be the ideal method as it can be administered without producing any water-logging of the tissues and one knows exactly the amount of the fluid given—a thing which cannot be ascertained if given per rectum on account of the irritability of the rectum and consequent rejection. For the first 2 or 3 days chances of water intoxication are remote as the tissues are both hungry and thirsty. Ten pints of 10 per cent glucose solution in 48 hours will yield about 1,800 calories and should be considered the minimal requirement. It is expected that from the third day there will be remarkable improvement, vomiting will stop, and the continuous intravenous saline may be replaced by fluid given by mouth. Five units of insulin may be given to prevent the loss of the sugar in the urine from the second day.

(6) Sedatives may be given in the form of bromides or barbiturates, about 40 to 60 grs. of bromides can be added to the night enema. Occasionally morphine gr.  $\frac{1}{4}$  can also be given.

(7) Intravenous administration of calcium is recommended by some (5 to 10 c.cm. of 10 per cent solution) every other day to protect the liver against necrotic changes.

(8) Endocrines, e.g., prolutan, lutocylin, corpus luteum, and extract of adrenal cortex are being used nowadays rather liberally.

The question of termination of pregnancy will only arise when the patient's condition goes down hill in spite of this energetic, systematic and adequate treatment. If properly treated, very few cases would require evacuation but the medical treatment should not be carried on too long. A case should be considered *severe* when, in spite of treatment, the vomiting persists, the patient's condition steadily goes down hill, she loses weight, the pulse rate increases, fever sets in, jaundice appears, vomiting becomes coffee-ground, bile appears in the urine, blood pressure drops, and psychosis develops. Of the various methods used, I would prefer slow dilatation by laminaria tents if the duration of pregnancy is less than 3 months, and vaginal hysterectomy if the duration is 3 months or over.

*Essential hypertension in pregnancy, nephritic toxæmia and pre-eclamptic toxæmia.*—My reason for taking these together is obvious; it is wellnigh impossible to make a sharp line of demarcation between these groups during pregnancy.

Pre-eclamptic toxæmia is characterized by high blood pressure, œdema, and albuminuria with subsequent development of oliguria, headache, giddiness and dimness of vision. *Abnormal increase in weight* is an early sign of pre-eclamptic toxæmia. No definite œdema is noticeable at the beginning except that the skin feels unusually firm. A few weeks later an increase in blood pressure is discovered, and later on, albuminuria and œdema may appear, the œdema usually preceding the albuminuria.

Hypertension is decidedly the most predominant feature, not only in pre-eclamptic toxæmia but also in nephritic toxæmia and essential hypertension in pregnancy, with this difference, that in the last two conditions it appears much earlier, whereas in the former it usually occurs later. The blood pressure is often much higher in essential hypertension than in either pre-eclamptic toxæmia or nephritic toxæmia, and remains high in spite of rest. There is a previous history of hypertension before conception in essential hypertension, and albuminuria is often absent throughout pregnancy. In nephritic toxæmia, a previous history of nephritis is also present, as well as cardiovascular changes which are absent in pre-eclamptic toxæmia. In nephritic toxæmia there is retention of urea-nitrogen in blood; the urea concentration may be below 2 per cent and urea clearance 50 or under.

Thus, the differentiation between nephritic toxæmia and pre-eclamptic toxæmia can to a certain extent be made by prolonged observation and investigation, by charting systolic and diastolic pressure regularly, by systematic urine examination, and by charting out kidney-function tests, namely, the urea-concentration test and the urea-clearance test. Even after doing all these, one still remains in doubt until after delivery, when the persistence of high blood pressure and albuminuria will give substantial



help in differentiating nephritic toxæmia from pre-eclamptic toxæmia, though it must not be forgotten that there still remains a mild form of chronic nephritis, I mean, occult nephritis, which is manifested neither by hypertension, nor by albuminuria, nor by any other delicate kidney-function tests, but by the acid test of pregnancy itself. This is why I took these groups together.

The management will be mostly medical: sufficient rest, low diet, consisting mainly of carbohydrates, vegetables, fruits and milk; saline purgatives and sedatives. If œdema is marked, restrict fluid and give salt-free diet; venesection may be needed, if the blood pressure remains persistently more than 180 mm. Hg. In more urgent cases, termination of pregnancy is advocated by induction of premature labour.

### Eclampsia

Eclampsia forms the most important group in the chapter on toxæmia of pregnancy on account of its increased frequency and enormous mortality. In spite of every possible sincere attempt, the maternal mortality rate remains practically the same.

The following tables and graphs will give a perspective view of the clinical aspect of eclampsia with reference to its incidence, prognosis and mortality.

Table I shows frequency of eclampsia as reported from different parts of the world. Curiously enough it is found to be commonest in India.

TABLE I

*Frequency of eclampsia as reported from different parts of the world*

Guy's Hospital Charity .. ..	1 in 842
New York City .. ..	1 in 700
Galabin .. ..	1 in 500
Vienna (General Hospital) ..	1 in 318
Eden Hospital, Calcutta (from 1848 to 1894).	1 in 106
Chittaranjan Seva Sadan, Calcutta (from 1927 to 1937).	1 in 33
Madras (Mudaliar) .. ..	1 in 58
Bombay (Telang) .. ..	1 in 131

Some time ago I made a study of the incidence of eclampsia in relation to different meteorological factors, viz, maximum and minimum temperature, rainfall and humidity. The only relevant factor found was that when the mean monthly temperature increases by 10°F., the incidence of eclampsia diminishes by 1 per cent.

TABLE II

*Distribution of primiparæ and multiparæ with mortality rate*

Parity	Number of cases	Number of deaths	Percentage of deaths
Primiparæ ..	179	28	16
Multiparæ ..	53	9	17

TABLE III

*Incidence of mortality according to œdema*

Total number of cases	Total number of deaths	Mortality according to œdema	
227	42	+	= 35
		++	= 5
		+++	= 2

TABLE IV

*Incidence of fits and their relation to mortality*

Cases	Number of cases	Number of deaths	Percentage of deaths
Under 10 fits ..	68	10	15
Above 10 fits ..	30	11	37

TABLE V

*Distribution of cases according to temperature with per cent mortality*

Temperature	Number of cases	Number of deaths	Percentage of deaths
Below 100 ..	158	12	7.6
Between 100-103 ..	34	7	20
Between 103-105 ..	20	6	30
Above 105 ..	19	15	79

TABLE VI

*Incidence of mortality according to mild and severe cases (according to London Committee's Report)*

Types	Number of cases	Number of deaths	Percentage of deaths
Mild ..	154	12	8
Severe ..	71	30	42

An eclampsia case is called a severe one when any two of the following symptoms are present, viz, (a) coma, (b) pulse over 120, (c) temperature above 103°F., (d) fits more than 10,

(e) albumin in urine + + +, (f) no œdema, and (g) blood pressure over 200.

TABLE VII  
*Racial distribution and mortality*

Race	Number of cases	Number of deaths	Percentage of deaths
Hindu ..	212	36	17
Mohammedan ..	14	4	29
Other caste ..	1	1	..

TABLE VIII  
*Distribution of eclampsia cases according to different types with per cent mortality in each type*

Types	Number of cases	Number of deaths	Percentage of deaths
Ante-partum ..	73	14	19
Intra-partum ..	104	21	20
Post-partum ..	47	6	13

TABLE IX  
*Analysis of fatal cases*  
Total 42

Hyperpyrexia ..	..	..	16
Pulmonary- complication ..	..	..	5
Sudden heart failure ..	..	..	5
Sepsis ..	..	..	4
Injury after psychosis ..	..	..	2
Coma ..	..	..	2
No definite cause found ..	..	..	8

Regarding the management of eclampsia, I believe that the radical surgical method has now been abandoned entirely, in favour of the conservative. Accouchement forc  has become a thing of the past and Cæsarean section is very exceptionally resorted to. The main principles of the conservative line of treatment are those indicated by Stroganoff's dictum which is : 'avoidance of all irritation to prevent the occurrence of fits'. Each successive fit will further damage the brain-cells and so they should be stopped at any cost, to prevent irreparable injury to the vital cells of the body. A practical outline of treatment would be as follows :—

Immediately on arrival (either of the patient at the hospital or of the physician to the patient) the patient should be put into a quiet, warm and well-ventilated room.

Excepting one or two strong-minded responsible persons, all relatives and visitors should be firmly requested to vacate the room. If possible, the patient is to be kept under the vigilant care of two obstetrically experienced nurses.

The patient will have a few whiffs of chloroform, the room is darkened and external noises excluded. The underlying principle

being to avoid all irritation, the patient should be kept away from all sorts of stimuli that might reach her either through ears, eyes and bodily movement. That is why chloroform is to be occasionally given whenever manipulations, external or internal, are done.

Immediately the patient has dozed off from the effects of chloroform, a quarter of a grain of morphine and  $\frac{1}{100}$  grain of atropine are injected subcutaneously.

Now the clothes are loosened and a catheter specimen of urine is taken, and a mixture containing 30 grains of chloral hydrate, 2 drachms of infusion of digitalis and 4 ounces of normal saline in each dose is ordered.

After exactly one hour, one dose of the above mixture is given per rectum slowly, and if the patient is restless, under chloroform. This is repeated at the 7th hour after the onset of treatment. By the time the patient is fairly under the narcotic, a careful vaginal examination is done and membranes ruptured, even if the os is not open. Only under exceptional circumstances, that is, when the patient is not at term and labour not likely to start, are membranes not ruptured. The idea of rupturing the membranes is to reduce the quantity of liquor amnii and thus to lower both intra-uterine and intra-abdominal pressure. This also hastens labour.

At the 3rd hour from the onset of the treatment, another injection of morphine is given, either gr.  $\frac{1}{4}$  or gr.  $\frac{1}{8}$ , depending on the irritability of the patient.

The patient is kept on her side as much as practicable and changed to the other side every 2 hours.

The physician in charge sits by the side of the patient all the time noting if any prodromal symptoms are appearing, as evidenced by restlessness, twitching of the muscles of the face and extremities, tossing of the head, fixation of eyes, and a fixed deviation of the head to one side. He should immediately start administering chloroform which is continued until the patient passes into the tetanic stage; it is then withheld. It will be a veritable danger to push on chloroform at the tetanic stage, because, soon after, the patient takes one long gasp in the next stage and concentrated chloroform will be inhaled by her. Oxygen inhalation is to be given liberally after each fit.

Generally, eclamptic fits occur one after another, and, if the fits are not controlled, the question of venesection should be seriously considered. According to Stroganoff (1930), if there are more than 3 fits after the treatment is instituted, venesection should be done immediately. About 7 to 10 ounces of blood are to be let out. Venesection has been found indeed life-saving on many occasions. Besides the question of fits, which stop in most cases almost immediately, even when the patient is found in a deep comatose condition with laboured stertorous breathing, venesection brings about

a complete change of picture. The patient becomes quieter, breathes easily and the rhonchi in the lungs which are the indication of approaching œdema decrease or even disappear. After venesection, blood pressure falls and angiospasm lessens; it facilitates the activity of the heart, lessens the œdematous condition; it lowers the concentration of toxins in the blood being a contributory factor towards diluting the blood; it lessens the chances of a hæmorrhage in the brain and contributes to a more intensive absorption of the narcotics by the intestines' (Stroganoff, 1930). If fits continue, venesection is to be repeated and there are cases where I have done it thrice with satisfactory results. Two points in this connection are worth while noting, i.e., eclampsia with low blood pressure and anæmia. Venesection is no contra-indication in these conditions if there are other indications present. It is advisable to inject glucose solution if there is low blood pressure, and to draw less blood in anæmia.

The patient should be kept covered with light warm clothing, and, to stimulate kidney function, warmth by way of poultices may be applied over the kidney region.

Obstetric interference in an eclampsia case should be practically nil, except rupturing the membranes artificially and hastening the second stage of labour by low forceps when the head is low down in the pelvis.

This practically completes the picture of treatment, except continuing the sedative mixture to the 22nd hour. But this time the dose of chloral hydrate can be reduced to 20 grains, provided there is a long interval between subsequent fits. This is the basal structure of the treatment but the individualization should never be overlooked.

There are certain modifications of treatment which require brief elucidation and criticism. Of late chloral hydrate has to a certain extent been replaced by paraldehyde. Chloral hydrate is a very effective medicine, but is supposed to be a cardiac depressant, although according to Stroganoff (1930) one can push it up to even 4 drachms in 24 hours. My experience with paraldehyde is not very encouraging. The patient becomes very restless and on some occasions she is quietened after a rectal wash.

Magnesium sulphate treatment is given more frequently nowadays than before. It apparently increases diuresis, diminishes œdema, lowers blood pressure and controls fits. It is administered either subcutaneously or intramuscularly. Not more than 24 grammes should be given in 24 hours. In certain cases the injections cause serious toxic effects and prove fatal. Acute cyanosis, feeble pulse and laboured breathing may develop for which the best antidote is calcium given intravenously.

Certain complications are worth while noting. Hyperpyrexia in eclampsia is dreaded by every obstetrician. Table V has shown how the death-

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## SHOULD ANTI-TYPHOID INOCULATION BE PRACTISED IN A HOUSEHOLD EXPOSED TO TYPHOID INFECTION?

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and

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ANTI-TYPHOID (T A B) inoculation has proved to be a valuable prophylactic agent, if employed when the immediate chances of contracting typhoid fever are minimal, but the opinion has been expressed from time to time that preventive inoculation undertaken during the course of a typhoid epidemic is dangerous. Many

(Continued from previous column)

rate increases with each degree of temperature. Out of 227 cases of eclampsia reviewed, 6 cases had temperature of 107°F. and one 108°F. All patients died except one. It is not humanly possible to do anything in these cases.

In some cases after the fits stop the patient may pass into a peculiar asthenic stage. These cases require vigorous cardiac stimulants and I know of cases where strychnine had to be given to get over this asthenic condition. I use cardiac stimulants in some form or other in all my eclampsia cases, because one does not infrequently notice that some patients while progressing well suddenly die of heart-failure with a negligible amount of strain.

Maniacal symptoms occurred in 7 cases (i.e., about 3 per cent), of which one patient was too violent to be kept at rest and died after a fall from bed. Cases with psychical disturbances should be placed under post-natal care. Post-natal care of the eclampsia cases forms a very interesting study and remarkable revelations have been made by Young and others.

Eclampsia cases have strikingly low resistance to infection. About 10 per cent of our cases had morbidity after confinement.

I will conclude by striking a note of warning that, frankly speaking, we have not made great progress in curing really bad eclampsia cases. The only secret of success lies in introducing thorough ante-natal care which can certainly prevent the bulk of eclampsia cases and render it less dangerous when eclampsia does supervene.

This has been done with striking success in other countries, for example, DeLee had no eclampsia in a service of nearly 3,000 obstetric cases in 1936.

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practitioners are undecided as to the best specific prophylactic procedure to be adopted in a household when one of its inmates is being treated in the house for typhoid fever. The difficulty that confronts them is, should the other members of the household be inoculated with T A B vaccine or not? The negative phase, it is suggested, may cause some individuals to acquire the disease who would otherwise have escaped, and yet others to develop the disease in a virulent form instead of suffering a milder attack.

*A recent incident.*—A colleague recently sought our help in this matter. He informed us that typhoid fever was introduced into a household of 25 members (including servants); one of the inmates fell ill with typhoid fever six days after his return from a long visit to his aunt who had typhoid fever at the time of the visit. All the members of the household were inoculated with T A B vaccine one month after the first outbreak and during the illness of the primary case. Two doses were administered, 0.5 and 1 c.cm. each, with 7 days' interval between. About eight weeks after the second T A B inoculation, one of the inmates fell ill with typhoid fever (diagnosed bacteriologically). It was a mild attack and the temperature reached normal on the 15th day. There was no relapse. A second case occurred 11 days after the first post-vaccinal case. This was a very severe infection; toxic symptoms were prevalent from the outset, fever continued for more than 7 weeks and the case was complicated with intestinal hæmorrhage. *Bacterium typhosum* was isolated by blood culture on the 10th and 17th day of illness, but the Widal reaction, carried out concurrently, showed no H or O agglutinins for any of the enteric group of organisms.

A third case occurred 2½ months after the T A B inoculation and about three weeks after the second post-vaccinal case. It was a moderately severe infection; blood examination was not allowed but a stool from this patient was secured for us on the 21st day of illness and *Bact. typhosus* was isolated. A fourth post-vaccinal case occurred on the day following the onset of the preceding case. It was a mild infection and no bacteriological or serological examination was done. There had been, therefore, four (three bacteriologically confirmed) cases of typhoid fever that occurred from 2 to 2½ months after T A B vaccination. The practitioner who administered the vaccine maintained that the domestic and personal hygiene of the household in question was such that it was not surprising that the vaccine was not able to ensure a 100-per cent protective value. The

head of the household maintained that either the vaccine used was not T A B vaccine, or, alternatively, if it was, then the inoculation had rendered the household susceptible and not resistant to typhoid fever.

*Recent work on this subject.*—Ramsey (1935) reported that of 2,886 contacts who did not receive prophylactic vaccine 7.03 per cent developed typhoid fever, whereas of 2,402 contacts, who were given three doses of vaccine subsequent to the primary case, only 0.3 per cent contracted the disease. Although Ramsey and others point out that there were many other factors besides preventive vaccination that may have influenced the above results, nevertheless there is no convincing evidence that typhoid vaccination has rendered contacts susceptible to infection.

Topley (1938) appears to be of the opinion that the argument in favour of inoculation of those who are in close contact with a case is greater than of those who are at risk as members of a population during a typhoid epidemic, because the risk to infection is greater, but that the danger of inducing provocative typhoid should always be considered.

Schütze (1939) found no increased susceptibility in mice experimentally infected with *Salmonella typhi murium* and inoculated with *typhimurium* vaccine during the incubation stage. He expressed the opinion that anti-typhoid vaccination of a community was, by analogy, to be recommended.

*The present investigation.*—The opportunity was seized to study the problem in the light of present-day knowledge afforded by the work of Felix and others on the Vi antigen of *Bact. typhosum*.

The material available was (a) T A B vaccine obtained from the same batch as that used for the inoculation of the typhoid-stricken household; (b) the typhoid strain (labelled by us 'typhoid corp') from which the vaccine had been prepared; and (c) *Bact. typhosum* isolated by us on the 21st day of the disease from the stool of the third case that contracted typhoid fever subsequent to T A B inoculation (labelled H/180).

The T A B vaccine was soon established as containing typhoid antigen by inoculation into rabbits and demonstrating the presence of typhoid H and O agglutinins in the serum raised.

Next, various tests were put up to detect any differences between the vaccine strain 'typhoid corp' and the case strain H/180. *Antigenic difference* was searched for by doing agglutination tests employing different typhoid sera. The results were:—

				Typhoid serum O 901	Typhoid serum H 901	Typhoid Vi serum
Vaccine strain ('typhoid corp')	..	..		+ (1/10,000)	+ (1/10,000)	— (1/20)
Case strain (H/180)	..	..		— (— 1/400, + 1/200)	+ (1/10,000)	+ (1/400)
Vi strain Ty. 2 ..	..	..		— (— 1/400, + 1/200)	+ (1/10,000)	+ (1/300)
Vi strain Bhatnagar	..	..		— (— 1/400, + 1/200)	+ (1/10,000)	+ (1/200)

The type of the clumps formed during agglutination was very different in the two strains under examination. The vaccine-strain clumps were large and flocculent, whereas the case-strain clumps were small and closely resembled those of 'Ty. 2' and 'Bhatnagar'.

*Differences observed by bacteriophage action.*—Pasricha and others (1937) showed that typhoid phage type I had a range of activity limited to strains known to contain Vi antigen and no activity for strains like O 901 and H 901, known to be devoid of Vi antigen. Craigie and Brandon (1936) showed that the sensitivity of Vi strains and V phage action are intimately related to Vi agglutinin and that the W forms of typhosum which do not possess this antigen are not susceptible to the action of V phage.

The V phage of Craigie and Brandon and the type I typhoid phage of Pasricha are said to be identical and subsequent investigation has confirmed this. This test was therefore employed to determine if there was this difference in the two strains under investigation. The following is the result of the test :—

for verifying if this was true for the two strains under investigation. Sixty mice between 18 and 20 grammes weight were divided into three equal groups of approximately the same weight. One group was inoculated subcutaneously with two doses of a vaccine prepared from the vaccine strain 'typhoid corp' and a second group was injected similarly with a vaccine prepared from the case strain H/180. The doses injected were 4 millions and 20 millions for the first and second dose, respectively, and there was an interval of three days between the two doses. The vaccines were prepared from 24-hour-old agar cultures, were suspended in normal saline, then heated at 55°C. for 20 minutes, standardized and finally carbolicized to contain 0.5 per cent phenol. They were taken into use one month after preparation. The third group of 20 mice was given the same amount of 0.5 per cent of carbolic-saline subcutaneously as the two vaccine-injected groups, and served as controls. On the seventh day after the second injection, each group was further divided into two; the mice in one half of each group were infected

		'Typhoid corp'	H/180	VI STRAINS		VI ABSENT OR MINIMAL	
				Ty. 2	Watson	H 901	O 901
V phage (Craigie and Brandon)	..	—	+	+	+	—	—
Typhoid phage type I ..	..	—	+	+	+	—	—
" " " II ..	..	+	+	+	+	+	+
" " " III ..	..	+	+	+	+	+	+
" " " IV ..	..	+	+	+	+	+	+

+ = phage action; — = no phage action.

*Virulence test.*—Two groups of ten mice each, of approximately the same weight, were inoculated each with one of the two strains under examination after preliminary trials had indicated the approximate lethal doses. 7,000 million organisms per animal of the strain H/180 killed all the 10 mice within 10 days, whereas 15,000 million organisms of the vaccine strain 'typhoid corp' were necessary to give similar results.

The tests clearly show the difference between the case strain and that employed for the preparation of the vaccine that had been given to the family with such, apparently, disastrous results. The indications are that the vaccine strain 'typhoid corp' is devoid of Vi agglutinin and the case strain H/180 is a Vi strain.

The distinct differences noted in the two strains raised the question as to whether a vaccine prepared with the one was capable of inducing protection against infection by the other. Schütze (1936) showed by animal experiments the importance of employing a full Vi strain in the preparation of antityphoid vaccine. Mice protected with a Vi strain had immunity 100 per cent greater than when an intermediate Vi strain was used. We took this opportunity

by injecting subcutaneously 15,000 million organisms of vaccine strain 'typhoid corp' and those in the other half of the three groups were given similarly 7,000 million organisms of the case strain H/180. The mice were observed for one month following the administration of the infecting dose. The results obtained are as follows.

It will be observed that the protection obtained by the inoculation of the vaccine strain ('typhoid corp') is of a low order (25 per cent saved) in both the groups and that resulting from the use of the case strain H/180 is sufficient to save 80 per cent of the 20 animals from death. The vaccine prepared from the case strain H/180 is able to protect 90 per cent of the mice when infected with the strain 'typhoid corp' and 70 per cent of those infected with the case strain. In both the groups of protected mice the numbers dying from infection with the case strain H/180 were slightly greater than those from infection with the vaccine strain 'typhoid corp'. This is probably due to the greater virulence of H/180 and in spite of the effort made to ensure that the lethal effect of the resulting doses of both the strains were approximately the same.

It may be inferred from this test that the vaccine strain 'typhoid corp' is not a suitable strain for immunizing purposes; that Vi typhoid strains are capable of raising resistance against infections by Vi and W typhoid strains and that Vi strain H/180 gave about three times greater protection than the W strain 'typhoid corp'.

From this experiment it is evident that vaccination of mice during the incubation stage does not render them less resistant to infection. The number of mice dying in the group inoculated with the vaccine prepared from the strain 'typhoid corp' is almost the same as those in the control group and the average length of life in all three groups is also very similar in all the

	INFECTED WITH 15,000 MILLION ORGANISMS OF STRAIN 'TYPHOID CORP'			INFECTED WITH 7,000 MILLION ORGANISMS OF STRAIN H/180		
	Alive	Dead	A. L. L. (days)	Alive	Dead	A. L. L. (days)
Group 1 Mice injected with vaccine prepared from strain 'typhoid corp' (20).	3	7	11.66	2	8	10
Group 2 Mice injected with vaccine prepared from strain H/180 (20).	9	1	13	7	3	12
Group 3 Control mice (20) .. ..	0	10	7.1	0	10	7.25

A. L. L. = Average length of life of those dying during the period of observation.  
N.B. = *Bact. typhosum* was isolated from all the mice that died.

A further experiment with mice was conducted on the lines adopted by Schütze (1939) to demonstrate, if possible, whether there is any increased susceptibility to infections in mice infected with a Vi strain (H/180) and inoculated during the incubation stage with a vaccine prepared from a typhoid strain in which the Vi antigen was minimal (like in 'typhoid corp').

Three groups of forty mice each of approximately the same weight were inoculated subcutaneously between the shoulders; each mouse received 6,000 million organisms of the case strain (H/180) that had been seeded on agar, incubated at 37°C. for 18 hours and suspended in distilled water. The volume injected was 0.5 c.cm. per mouse. The same two vaccines prepared previously, but taken into use three months after preparation, were administered 24 and 72 hours after infection. One group was given 4 million organisms at the first dose and 40 millions at the second, of the vaccine prepared with the strain 'typhoid corp'. The second group received similarly two doses of the vaccine prepared with the strain H/180.

The third group received 0.5 c.cm. carbolized saline and served as controls.

The following are the results obtained:—

three groups. A point worthy of notice is that vaccination with H/180, 24 and 72 hours after infection, not only does not render the mice less resistant but that it appears to increase their resistance.

*Discussion.*—Four cases developed typhoid fever subsequent to preventive inoculation, none of which could reasonably be considered as infections in which clinical symptoms had been precipitated by preventive inoculation. Provocative typhoid is usually a severe infection occurring soon after the inoculation, whereas here the first case developed clinical typhoid eight weeks after T A B inoculation and the disease was an usually mild infection considering that the primary case and the other two post-vaccinal cases were severe infections. The other possibility is that the post-vaccinal cases were the result of lowered resistance consequent to preventive inoculation. The investigation carried out shows that the typhoid strain employed for the preparation of the vaccine injected into the inmates of the typhoid-stricken household was a W strain and unsuitable for immunizing purposes. The first animal test conclusively shows that in mice the strain 'typhoid corp' induces a low grade of protection

	GROUP 1		GROUP 2		GROUP 3	
	Forty mice infected with H/180 and given subsequently 2 doses of the vaccine prepared with strain 'typhoid corp'		Forty mice infected with H/180 and given subsequently 2 doses of the vaccine prepared with strain H/180		Forty mice infected with H/180 and given subsequently 2 doses of carbolized saline	
	Alive	Dead	Alive	Dead	Alive	Dead
Number ..	21	19	25	15	22	18
A. L. L. (days) ..	..	7.1	..	7.5	..	7
Percentage ..	52.5	47.5	62.5	37.5	55	45



in marked contrast to that produced by the case strain H/180. Animal experiments conducted to ascertain if lowered resistance can be induced in mice by inoculating a vaccine prepared with the strain 'typhoid corp' shortly after infection with H/180 showed no definite lowered resistance.

The opinion that anti-typhoid preventive inoculation is dangerous during epidemic times is based mainly on coincidence. No investigation to our knowledge has been conducted to determine the precise conditions under which preventive inoculation induces a refractory state. This particular household (where 4 post-vaccinal cases occurred among 25 close contacts) might have served as an additional example of the danger of T A B inoculation and the existence of a negative phase, if our investigation had not indicated otherwise. It is useless to speculate as to how many of the individuals who developed typhoid after anti-typhoid inoculation had received a vaccine prepared from unsuitable strains.

It is suggested that, where possible, instances in which T A B inoculation appears to have rendered individuals susceptible should be carefully investigated before the presence of 'negative phase' is accepted as an explanation.

Our animal experiments were designed to reproduce in mice the two main conditions, namely, inoculation of a vaccine prepared from the same strain as that used for the preparation of the vaccine administered to the household and the injection of the same infecting typhoid strain. The vaccine was administered before infection and subsequent to infection, and in neither instances was any evidence of lowered resistance to the progress of infection detected.

Although drawing analogies from animal experiments is not always safe, the more so as they were not entirely parallel, in that the end point in these experiments was death, whereas development of the disease, irrespective of whether death or recovery ensued, should have been the criterion, nevertheless it may be recommended that preventive T A B inoculation may be practised in a household of close contacts. Some physicians recommend Besredka's bili-vaccine, others typhoidphage. We have no experience of these two agents as preventives in typhoid fever and until evidence that they are effective preventive agents is obtainable, or until it is definitely shown that preventive T A B inoculation does induce a 'negative phase' preventive anti-typhoid inoculation in addition to general hygienic measures should be adopted, provided that the vaccine used had been prepared from a fully Vi typhoid strain.

#### Summary

1. Three cases of post-vaccinal typhoid fever occurred in a household of 25 members all of whom had been inoculated with T A B vaccine from 1½ to 2¾ months previously.

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## KERATODERMIA BLENNORRHAGICA

### A BRIEF REVIEW AND REPORT OF A CASE

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KERATODERMIA blennorrhagica is a comparatively rare but characteristic cutaneous condition usually associated with gonorrhoea and polyarthritides. Vidal in 1893 was the first to observe and describe this syndrome in a patient suffering from gonococcal polyarthritides. Since then cases have been published both in Europe and in America. In 1924 Keim described the histogenesis of the cutaneous lesion from a case under his observation and distinguished it from pustular psoriasis. Lees and Percival (1931), in a brilliant contribution and report of eight cases, discussed in detail the histology and clinical characteristics which confirmed Keim's observations.

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2. The vaccine used was proved to contain typhoid antigen.

3. The strain used for the preparation of the vaccine was a W strain, whereas the infecting organisms in at least one case was a Vi typhoid strain.

4. Animal experiments showed that the vaccine strain induced only a low grade of immunity, in marked contrast to that produced by the case strain.

5. Preventive inoculation of the vaccine strain 'typhoid corp' to mice, 24 and 72 hours after infection with the case strain H/180 does not render the animals less resistant to the progress of the infection; and preventive inoculation of the case strain H/180 similarly infected with the case strain H/180, not only does not lower resistance but actually increases their resistance, so that a larger percentage of mice survive.

6. In the absence of more definite evidence that T A B inoculation is dangerous and of any alternative specific prophylactic measure, T A B inoculation may be recommended for close contacts of typhoid fever.

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### *Ætiology*

Though the association of keratoderma, urethral gonorrhœa and polyarthritis was a constant feature in most of the observed cases, indicating a condition of gonococcal septicæmia, the culture of the blood and scrapings from the lesions have invariably yielded negative results. The consensus of opinion now points definitely to the cutaneous eruption being an allergic expression of a sensitized skin, the sensitization taking place either directly or indirectly through the nervous system (Lees and Percival, 1931). The observation of Scholtz (1927) of the sudden appearance of fresh crops of cutaneous lesions, after the administration of a gonococcal vaccine—a sort of Herxheimer reaction—suggests the gonotoxic nature of the lesions. The occurrence of an endogenous conjunctivitis, a polyarthritis and a temperature of a septic type certainly points to a profound systemic toxic-allergic disturbance.

Attempts to reproduce the lesion by auto-inoculation have given conflicting results. According to Haase (1916) any abrasion of the skin during the height of eruption is liable to result in the formation of a keratoma. Strandberg, Hedencus, Adamson and Bogrow, however, throw doubt on the gonococcal nature of the cutaneous eruption. They contend that the clinical and histopathological features of the fully-developed keratoderma blennorrhagica and of arthropathic psoriasis are so nearly identical that it is unnecessary to bring in the elusive gonococcus as the ætiological offender in these cases and that the former are only examples of the latter. But Keim (1924) and later Lees and Percival (1931) have proved that the initial lesion in keratoderma blennorrhagica is a vesicle which becomes a pustule and rapidly undergoes desiccation. Plasma cells, which are a prominent feature in keratoderma blennorrhagica, are totally absent in arthropathic psoriasis; and endogenous conjunctivitis never occurs in the latter.

### *Clinical characteristics*

The disease is rare. The incidence of this condition varies from 1 in 5,000 (Harrison) to 1 in 7,500 (Brown and Hargreaves) of gonorrhœal urethritis. Up to 1940, only 93 cases have been reported in the literature. The cutaneous eruption occurs almost exclusively in men though a few cases of the condition in women, and one in a girl of four years, have been reported by Isaac, Lees, Robert, Finlay and others.

From the recorded description of the clinical manifestations of this disease, the syndrome of keratoderma blennorrhagica may be said to comprise (1) urethritis of gonorrhœal origin, (2) polyarthritis, (3) inflammatory crusted horny lesions of the skin, which may be generalized but are usually symmetrical, (4) a swinging temperature, (5) a profound cachexia and anæmia, and (6) other associated lesions which

are not constant. (1) and (2) almost always precede the appearance of the cutaneous eruption.

The urethral infection is usually subacute or chronic with involvement of the prostate and seminal vesicles; and is followed by a severe type of polyarthritis.

Several joints, either symmetrically or asymmetrically, are simultaneously affected. The knee, the ankle or the wrist joints are most commonly involved. The swelling and redness of the joints are minimal; the pains are excruciating and the tenderness and limitation of movement very disabling. In severe and neglected cases there is atrophy of the muscles above and below the joints.

The cutaneous lesions are usually, if not invariably, preceded by chills and a temperature of a swinging hectic type. The eruptions may be generalized but have a predilection for the soles, palms and genitals. The distribution is symmetrical. Less frequently they may also occur on the trunk, scalp, legs, forearms and mucous membrane of the mouth.

The eruption starts as a number of vesicles which enlarge and undergo pustulation, desiccation and crust formation. The fully-developed lesion presents the appearance of a conical, dirty, dark brown, horny mass with a slightly truncated and umbilicated top. Contiguous masses may coalesce, forming large geographical areas, and giving the appearance of mountains on a relief map. The greater part of the sole may be entirely covered by one of these heaped-up caked conical horny masses. Slight pressure on the lesion with the tip of the finger gives a sensation resembling that caused by pressure on an empty vesicle or bulla. It takes, on an average, about two weeks for the development of the mature lesion. Removal of the crust leaves a superficial, slightly moist, eroded surface which quickly assumes a blotchy pigmented appearance. There is no bleeding, scar or induration left after the masses fall off.

Keratosis of the nails of the toes is not uncommon and is particularly distressing to the patient. The lesion appears underneath the nail plate which is lifted from the bed, becomes dry, brittle and opaque with the free border broken and serrated. A subungual keratoma is often associated with contiguous lesions on the integument surrounding the nail.

Lesions of the mouth and genitalia are sometimes observed. They are different in appearance from the cutaneous lesions and the evolution is more rapid. Umbilicated papules with greyish borders appear on the mucous membrane of the palate, cheek, tongue, prepuce and glans penis. They disappear in a few days leaving raw eroded areas.

During the course of the disease other clinical lesions have been observed and recorded by various investigators. Of these, recurrent endogenous conjunctivitis, usually bilateral, is a not infrequent occurrence. Iritis, corneal

ulceration, retinitis and anterior synechiae have also been reported. A rare condition is an associated endocarditis or myocarditis.

### Diagnosis

The triad—urethritis of Neisserian origin, metastatic polyarthritis of the same aetiology and the presence of the characteristic cutaneous eruptions—should render the diagnosis a comparatively easy matter.

Keratoderma blennorrhagica is distinguished from arthropathic psoriasis with which it has a superficial clinical resemblance, by the distinct histological architecture of the keratoma lesion, so ably described by Keim and others. Cachexia and endogenous conjunctivitis are usually absent in the latter. Crusted syphilitic lesions should offer no difficulty to the experienced clinician as the clean-cut ulcer of a rupioid or ecthymatous syphilide is revealed on detaching the superimposed crust; other evidence of syphilis will be present.

### Treatment

The treatment of this condition consists essentially in the attack on the primary focus of the infection in the urethra, prostate and seminal vesicles. Both the arthritis and cutaneous manifestations will subside with the eradication of the primary infection.

The most effective therapeutic procedure comprises (i) oral administration of one of the sulphanilamide compounds, (ii) induction of artificial fever by one of the many methods, (iii) in chronic cases, promotion of drainage from obscure foci in the urethra, prostate and seminal vesicles, and (iv) general measures such as rest in bed, careful nursing, nourishing food, and tonics during convalescence. As these patients are highly allergic and cachectic, specific vaccine therapy is not advocated by the majority of clinicians. The cutaneous lesions do not require any special treatment. With measures (i) and (ii) the joint condition shows rapid amelioration; pains subside and mobility is restored. The urethritis responds well to chemotherapy but any residual focus of infection in the adnexal structures may require treatment by massage, instillations, dilatations, etc. Even in an adequately and thoroughly treated case, it is a matter of three to four months before the patient regains completely normal health.

If, according to European and American clinicians, keratoderma blennorrhagica is a rare condition in their countries, it seems to be rarer still in this country. A review of the statistics of the Venereal Department of the Government General Hospital, Madras, shows that there have been approximately 20,000 cases of gonorrhoea treated during the past decade. Yet the following case is the first and only authentic report of keratoderma blennorrhagica for Madras, if not for the whole of India, because we are not aware of any report of a case of keratoderma blennorrhagica from this part of the world within the past ten years.

### Case report

A Hindu male, aged 25 years, was admitted to the Venereal Department of the Government General Hospital, Madras, on 20th December, 1940. He gave a definite history of gonorrhoeal urethritis with a terminal hæmaturia about six months ago. On the advice of a medical practitioner he took about 25 tablets of one of the sulphanilamide compounds orally. Two months before he sought admission to the hospital, pain and swelling developed in a number of joints and simultaneously there appeared crusted cutaneous lesions on the soles, legs, knees, etc.

**Physical examination.**—The patient was brought on a stretcher. He looked very ill, emaciated and cachectic. The temperature was 100.8°F. and the pulse rate was 120 per minute. He had multiple arthritis involving the knees, ankles and the metacarpo-phalangeal joints of the right thumb. The periarticular swelling of the joints was minimal but there was excruciating pain on palpation or on slight movement of the joints; so much so that he was miserably helpless in even trying to turn in bed. There was marked atrophy of the muscles above and below the affected joints.

The outstanding feature was the cutaneous eruptions which were almost generalized though most marked in the lower extremities. The distribution was as follows:—

- (a) discrete scattered lesions on the back (plate XXV, fig. 1), anterior abdominal wall, both inguinal regions,
- (b) closely-set lesions on the dorsal aspect of left elbow, volar aspect of left forearm, round about both knees and legs (plate XXV, fig. 2).
- (c) confluent lesions on the soles of the feet, particularly on the instep and balls of the toes, and
- (d) subungual keratomas involving almost all the nails of the feet (plate XXV, figs. 3 and 4).

The eruptions were a dirty dark brown, cone-shaped, or umbilicated at the top with peripheral crust. Some of the younger lesions were dark yellow and waxy looking. Removal of a fully-matured crust revealed a shiny moist surface without ulceration or bleeding.

The nail of the great toe on the right foot was loose in its bed due to the pressure of a subungual keratoma.

There was marked congestion and redness of the conjunctivæ without any chemosis. The lips were dry, fissured and scaling. The tongue was brown and coated.

**Investigations.**—A urethral smear and centrifuged deposit of urine showed only pus cells and no gonococci on repeated examination. Prostate and vesicles nil abnormal. A dark-ground examination of the lesion was negative to *Treponema pallidum*. A stained smear of scraping from the base of the lesion was negative to gonococci. The serological reaction of the blood was reported as positive to syphilis though no history or clinical evidence of syphilis was available. The routine cytological examination of the blood showed a mild anaemia with a moderate leucocytosis. The blood pressure was 110/80.

**Treatment and progress of the case.**—The patient was kept in bed and absolute rest enforced. Sulphanilamide tablets were administered orally at the rate of 4.5 grammes daily for three days and stopped on account of intolerance. Artificial pyrexia was induced by the intravenous administration of T. A. B. vaccine. A course of six injections in increasing doses of 25, 50, 100, 200, 400 and 800 millions was given on alternate days. The arthritic condition rapidly improved and the patient was able to move his limbs without pain at the end of the pyrexial therapy. The endogenous conjunctivitis subsided and the crusted lesions on the body dropped off or were easily removed. By the end of the third week of therapy the skin lesions disappeared leaving slightly blotched pigmented areas. The subungual keratomas were removed with some of the loose nails. The patient was able to move about freely by the end of a month after therapy; and now three months after cessation of treatment the patient has put on weight and remains well, with no

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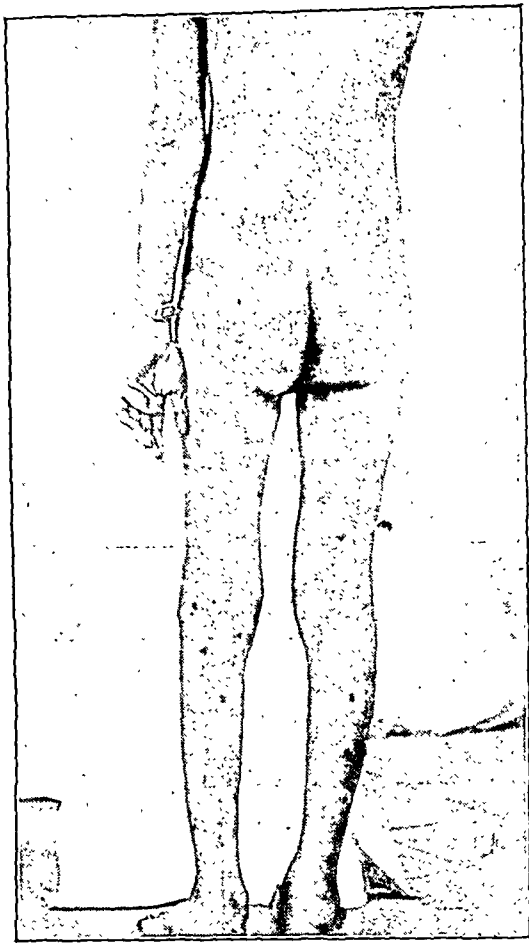


Fig. 1.—Discrete lesions on the back and posterior surface of lower limbs with blotchy depigmented areas.

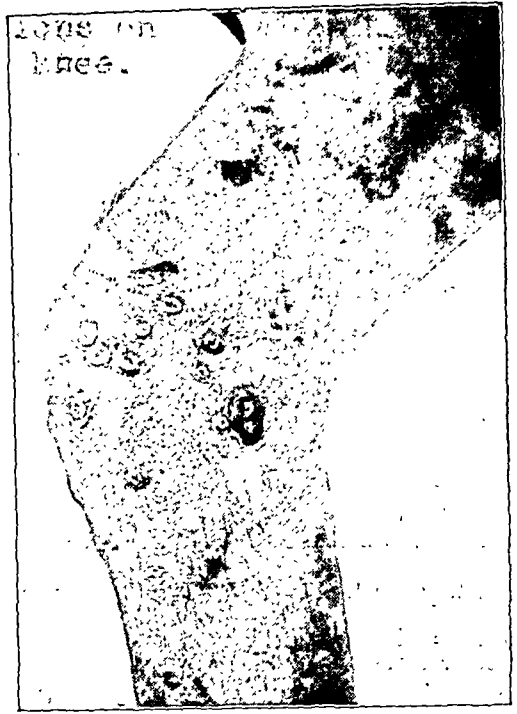


Fig. 2.—Lesions on the knee.



Fig. 3.—Lesions on the right foot and toes.



Fig. 4.—Lesions on the instep.

PLATE XXVI  
MEDIASTINAL HERNIA: R. VISWANATHAN



Fig. 1. *Case 1.*—After partial gas replacement. Note the fluid level extending beyond the heart shadow and stopping abruptly at the outer margin of the herniated left pleura.

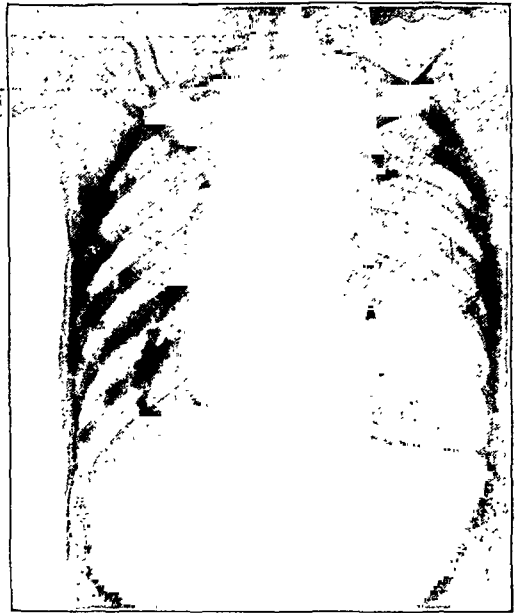


Fig. 2.—Same case after subsequent aspiration. The herniated pleura has failed to come back owing to possible adhesions. Patient had no distress.

DOES A LUNG CAVITY EVER HEAL SPONTANEOUSLY?: G. C. CHATTERJEE



## MEDIASTINAL HERNIA

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MEDIASTINAL hernia is the protrusion of a portion of the contents of one hemi-thorax with the mediastinal pleura, through the mediastinal space into the contralateral hemi-thorax.

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recrudescence of either the arthritic or the cutaneous manifestations.

### Comment

Though the patient gave a definite history of gonorrhoeal urethritis when he came under our observation, repeated examination of the smear, urine and prostatic secretion failed to show any Gram-negative diplococci but only pus cells and banal organisms. According to Epstein (1939) the absence of gonococci does not hamper the diagnosis of keratoderma blennorrhagica as gonococci were demonstrated in only 74 per cent of 23 cases investigated by him.

Downing (1934) pointed out that Vidal considered keratoderma blennorrhagica to be a syphilitic manifestation. Even to-day this theory appears to find favour with MacKenna (1937) who writes in his book on skin diseases that some of the cases reported have been syphilitic in origin. Though the case under report had a positive serology there was no history or clinical evidence of syphilis and the lesions themselves did not bear any resemblance to cutaneous syphilitic eruptions.

### Summary

A review of keratoderma blennorrhagica is presented.

A case of keratoderma blennorrhagica, the only one of its kind observed in the Venereal Department of the Government General Hospital, Madras, is described and its rarity stressed.

We thank the superintendent of the Government General Hospital for permission to utilize the records of the department and to the staff of the Barnard Institute of Radiology for the photographs.

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(\* Not in authors' reference list: supplied by the editorial staff.)

Herniation of the mediastinum should not be confused with the deviation of the mediastinum, common in thoracic disease. Some mediastinal displacement is usually associated with herniation, but in mediastinal hernia a portion of the pleura itself penetrates the mediastinum to the opposite side.

*Ætiology and pathogenesis.*—Even though there is almost complete and effective separation between the two pleural sacs, there are three 'weak places' where the two pleuræ are separated from each other only by loose connective tissue. The first area lies subjacent to the sternum in the anterior mediastinum where the medial reflections of the pleura are normally very close together. The second spot is in the lower posterior mediastinum between the aorta posteriorly and œsophagus anteriorly, from the 5th to the 11th thoracic vertebra. The third weak spot is in the posterior portion of the mediastinum lying between the vertebræ posteriorly and the œsophagus anteriorly, from the third to the fifth thoracic vertebra. This upper posterior weak space is separated from the lower by the vena azygos. Through any of these weak spots, more commonly through the first two areas, can herniation occur.

It is not uncommon to get mediastinal herniation during the administration of therapeutic pneumothorax. Packard (1927), Doub and Jones (1937), and the writer (1939) have reported the incidence of this complication during artificial pneumothorax therapy. Maier (1938), on the other hand, has noted the occurrence of mediastinal hernia in the absence of pneumothorax, and has emphasized the clinical importance of recognizing this condition, particularly when surgical procedures are adopted for intra-thoracic diseases.

Any condition that produces a marked difference in the intrapleural pressure on either side might result in a mediastinal hernia. This is more likely to occur in the absence of thickening and fibrosis of the mediastinal pleura.

The pleural protrusion might occur towards the normal side as in cases of massive effusion or pneumothorax which produces increase of intra-hemi-thoracic pressure of sufficient degree to produce bulging of the mediastinal pleura into the opposite side. In other cases there is an invagination of the diseased side by compensatorily enlarged contralateral lung. This occurs in those cases of pulmonary tuberculosis where there is a considerable amount of contraction fibrosis of one lung. It also might occur in conditions producing massive collapse of one lung, as in tumours of or foreign body in the bronchus. Other conditions in which herniations might occur are unilateral bronchiectasis with marked fibrosis and cystic disease of one lung.

*Symptoms and diagnosis.*—A diagnosis can be made if the possibility of hernial protrusion is borne in mind associated with any chronic thoracic disease which is likely to cause a

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## DOES A LUNG CAVITY EVER HEAL SPONTANEOUSLY ?\*

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IN view of the very extensive surgical procedures that are being adopted in the treatment

\* Abridged by the Editor.

(Continued from previous page)

shifting of the mediastinum. No doubt during the course of artificial pneumothorax therapy the possible occurrence of mediastinal hernia should be borne in mind. In the writer's series very few cases suffered from any symptoms pertaining to this complication. Only one complained of dyspnoea. A few complained of sub-sternal tightness sometimes amounting to actual pain.

In cases of pulmonary tuberculosis with atelectasis of a large portion of one lung existing for a long time or with marked shrinking of the lung due to fibrosis, mediastinal hernia is liable to occur. The physical signs due to this complication are very few. If it is through the anterior mediastinum there might be resonance present over the sternum and near the sternum on the opposite side.

The diagnosis of the condition mainly rests on radiographic examination. The radiological appearance of the hernia occurring during artificial pneumothorax therapy is that of a well defined curvilinear shadow on the opposite side of the mediastinum. In other conditions, particularly in tuberculous fibrosis, it may be difficult to diagnose hernia owing to the increased density of the shadow due to the pathological condition of the lung itself. Tomography is useful for diagnosis of the mediastinal herniation. In its absence stereoscopic roentgenograms with the Potter-Bucky diaphragm are a great aid. Lipiodol bronchography of the diseased lung will help in the diagnosis of anterior mediastinal hernia, as it will show the downward and backward displacement of the bronchial tree of the upper lobe of the affected lung associated with the large amount of the herniated lung in which no lipiodol will be seen.

Hernia of the mediastinum can be distinguished from displacement by the fact that in the former condition the lung is found protruding beyond the trachea into the opposite side.

*Treatment.*—Reduction of pressure in cases of pneumothorax is enough to reduce the mediastinal hernia. In those cases where the hernia is due to contracture of one lung, treatment of the diseased side, preferably by thoracoplasty, will give relief to the symptoms if there have been any.

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of tuberculosis, it behoves one to consider whether a cavity ever heals spontaneously, and, if it does, under what conditions and how, so that, guided by this knowledge, the physician may avoid, in such cases, surgical interference, with its attendant risks. It is also necessary to enquire whether surgical interference here has the same curative value, as the removal of the septic joint or limb, or an appendix which removes for all time the causative element from the system altogether, or whether it is done to help in the fight against the germ of tuberculosis which was begun long before the operation and will be continued for even longer after the operation.

A quotation from one of the most outspoken writings of an advocate of one type of surgical interference (operators are not unanimous in selection of their procedures, one set condemning the other's procedure), namely partial thoracoplasty, or apycolysis, as it is termed, will give us an insight into their line of thought. Coryllos (1935) the advocate of this method says, in justification of applying his method in curing cavities, the following :—

'Instead of being a passive observer of letting nature act and hoping for the best, he (the surgeon) is becoming an active, daring, open-minded and scientific crusader, his immediate objective is the definite, early and economic cure of tuberculosis patients. His further aim is the eradication of the disease by early suppression of tubercle bacillus carrier. The objective of the method devised for the purpose is not only the cure of the disease, but also the preservation of the anatomical and physiological integrity of the healthy part of the lung. These procedures represent the modern ideas, actual trend and tendency in the treatment of pulmonary phthisis.'

Though the natural interpretation of the above lines taken from its context would suggest that this operative procedure is the only method advocated by the above writer, for all cavities and with it tuberculosis of the system, yet, to do justice to the writer, I must say that he admits in the same paper the occurrence of spontaneous cure of a certain type of cavity, which should not therefore be operated upon\* and also that there is difficulty in recognizing a cavity by x-ray, for example in annular absorption of an exudative lesion which very often simulates a cavity. Lastly, in general criticism of the above assertion without going into details, it is necessary to state also that the operative procedures are changing from year to year, newer methods are continually being advocated by fresh workers. For example, apycolysis advocated by the above writer has a reputation of not more than five years and, even within this limited period in some of his cases which were operated upon by this method with expectation

\* 'The acute benign exudative productive form of pulmonary tuberculosis of Ornstein, Ulmar and Dittler, heals as a rule spontaneously by bed rest alone and requires no surgical interference, so also the chronic productive form of Ornstein and Ulmar. The question of cavities is complicated by the existence of so-called annular shadows.'—Coryllos (1935).

of complete cure, the tubercle bacilli did not disappear and others have flared up ending in death. So the above sweeping assertion that these operative procedures will cure cavities, and with them tuberculosis, is not supported by facts. Moreover, the finding of a large number of cases with cavities, who have not been operated upon at all remaining healthy for years (for 20 years or more) with subsequent disappearance of cavities, as proved by x-ray, will make one wonder whether the optimism to rely on sanatorium treatment only has not a better basis in fact and whether the conservative treatment should be set aside lightly in favour of the above procedure.

So, without discussing further the merits and demerits of operative procedure, I will describe one case among several others with which I have had to deal where this spontaneous healing took place.

#### *Summary of one case*

*Case note.*—The patient, aged 35, who was employed in a business firm in Calcutta, stated that his weight before his complaint started was 112 lb. He suffered at first from pleurisy in the right side, for which he underwent some form of treatment but there was no fever nor did it incapacitate him for his work; he only lost weight. He suddenly one day started after an attack of influenza bringing out a huge quantity of blood and being unrelieved by ordinary treatment, artificial pneumothorax (A-P) was performed, and as this apparently stopped the hæmorrhage, he was persuaded, for complete cure of his disease, to take further A-P (as will appear later, air could not be introduced on account of adhesions, so this was more or less a show). During this period, covering two years, two x-ray films were taken: one showed infiltration and the second a cavity in the right apex. Finding that he was not getting cured, the patient went to a sanatorium situated in a hill station where the doctor in charge, taking another film, agreed in the opinion of the previous doctor that there was a huge cavity, but as there were adhesions he said A-P was not possible.

Phrenic nerve avulsion was advised but not done; then he started giving him calcium and gold. As hæmoptysis and fever followed this line of treatment, the patient came out of the hospital, as a hopeless case of tuberculosis and, his funds being exhausted, came back to his home to die. He lay in bed for two years, when I saw him for the first time in March 1940; he was apparently in enjoyment of good health, but had a markedly crepitant patch in the right supra-clavicular region, accompanied with cavernous breathing. As I found no justification for making him lie down, for he had no fever, I encouraged him to come to my clinic, which he did three months after I saw him. At that time, I found his weight 144 lb., no crepitant patch could be found in the apex, but, in its place, blowing breathing; no cough and no fever. Weight increased by weekly tuberculin treatment from 144 to 151 lb. He was able to walk a good distance without getting any fever and there were no physical signs. An x-ray taken at this period showed the fibrosed remnant of the old cavity with the heart drawn to the left side (plate XXVI).

*Discussion.*—It is well known that whenever the tubercle bacillus enters the system, the latter responds by producing what is termed allergic response by which the invading germ is prevented from making any further inroads. As a result the disease either becomes localized or the germ is destroyed altogether. The reverse can

take place—the activity of the invading germ may break down the resistance and may destroy the organism. The former condition is under consideration here, where, as a result of localization of the disease, the system became immune, completely or partially, to the further invasion of the germ. When this immunity was in process of taking place, the physiological condition of the patient improved, and he started picking up in health. The lesion became fibrosed giving here a concrete illustration of how immunity is produced, the surgeons fixing their attention entirely on the x-ray findings and ignoring the fact that the cavity was getting fibrosed. It could not be made out by x-ray alone that he was healing by himself, in spite of the surgical interference, which was unnecessary; they did not in fact succeed in what they aimed at, namely, immobilization of the lung by putting air into the pleural cavity.

The next question to be decided is whether all cavities left after quiescence of the disease become obliterated by fibrosis as happened in this case, or remain as open spaces, with the sword of Damocles hanging over the patient's head, as at any time the unsupported arteries around the cavity may burst and lead to instantaneous death, or whether secondary metastasis will take place from caseous unhealed portions in the walls of cavities. Though these dangers are not absolutely groundless (I have seen one case dying in this way), yet the fact remains that in many patients with whom the writer has had to deal the cavities have not collapsed. This fact has been found out only by x-ray taken more out of curiosity a long time after the active symptoms have passed away, the patients being at that time in enjoyment of perfect health and without physical signs.

So the conclusion to which we come is that healing by fibrosis of the cavity takes place, with the healing of the tuberculosis of the system, in many cases and is a part of ordinary healing process. Whether it does so in all cases, it is not possible to say.

[*Note.*—As Dr. Chatterjee has been one of the leading spirits in the anti-tuberculosis movement in Bengal and has had considerable experience, we feel that we must allow this expression of opinion on the surgical treatment of tuberculosis, though many, amongst whom we include ourselves, will not agree with him on this subject.

The case he quotes is a good example of how a cavity may heal up without treatment. It is also a sad story that—on the face of it for the evidence rests mainly on the statements of the patient—suggests malpraxis on the part of one doctor, culpable condonation on the part of another (*see appendix*), and extreme gullibility on the part of the patient. It however provides no criticism of the honest surgical treatment of tuberculosis in appropriate cases.

The report conveys the salutary warning that one should not attribute success to any particular treatment, just because a patient happens to get better after he has received this treatment. Nature may be following its natural healing course despite treatment.—EDITOR, I. M. G.]

## APPENDIX.

FULL REPORT OF THE CASE, WITH DESCRIPTION OF  
SKIAGRAM AND ITS INTERPRETATION

A summary of the record of the case, as made out from the written statement by the patient.

1928.—Dry pleurisy in right side. Weight 112 lb. Working.

1928-30.—Slight pain in the right side. Weight 108 lb. Working.

1931-33.—No complaint. Weight 104 lb. Working.

1934.—Influenza, followed by severe hæmorrhage. Artificial pneumothorax (A-P) done to stop hæmorrhage and then after its stoppage continued almost every other day as treatment of tuberculosis, though it was pointed out by the physician in charge that no air was getting in, due probably to adhesions; 40 'A-P's' done. X-ray film showed at that time infiltration in the right apex; no fever all the time; weight 148 lb. Then he started getting fever. X-ray taken in September showed a big cavity.

A-P was resumed, followed by fever and bleeding. Then this line of treatment was discontinued. This time a drop of arnica stopped the bleeding.

1936.—Fever, bed-ridden. Weight 149 lb.

1937.—Went to a sanatorium in the hills. It was snowing at the time. Temperature stopped within three weeks of his going there. X-ray taken there showed even then a big cavity. Weight 161 lb. Phrenic nerve avulsion was suggested, but not done on account of the patient's unwillingness. Then calcium and gold treatment was adopted—followed by fever and bleeding. Left sanatorium. Weight 148 lb.

1938.—After coming home, fever stopped for a while, but hæmoptysis occurred with occasional slight fever, making him bed-ridden. Weight 140 lb.

1939-40.—No treatment, bed-ridden.

1940-41.—The writer saw him for the first time in March 1940 apparently as a hopeless case of phthisis. He found a crepitating patch and blowing breathing over the right apex. The patient was advised to move about, which he did, and to take a course of tuberculin treatment at the writer's clinic, as an ambulant case. Weight has gone up from 144 to 151 lb. Now has no fever, nor bleeding, and no physical signs can be elicited. X-ray taken on 6th February, 1941, showed a marked fibrosed patch replacing what was a cavity.

*Copy of report of radiologist of x-ray film of case taken on 3rd February, 1941*

Diaphragm excursion.—Restricted movement right side.

Heart.—Cardiac retraction. Skiagram—heart pulled to the right side—smaller.

Hila.—Right—obliterated, due to cardiac retraction and peritracheal thickening. Left—few fibro-calcific nodes and congested vessels.

Lungs.—Right: Apex—homogeneous dense shadow involving the upper lobe with marked cardiac and tracheal retraction, probably indicating chronic diffuse interstitial fibrosis of the lung. Base: Slight pleural thickening and adhesion of the lung.

Left: Apex—accentuated broncho-vascular trunks and evidence of cluster of coarse nodular infiltration in the periphery (1st, 2nd and 3rd) intercostal space. Base: Costo-phrenic angle free.

Conclusions.—Fibrosis—right upper lobe and left coarse nodular infiltration-periphery.

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A NOTE ON COMPLEMENT-FIXATION  
TEST IN LEPROSY AND KALA-AZAR  
WITH WITEBSKY, KLINGENSTEIN  
AND KUHN (W. K. K.) ANTIGEN

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THE intention is to draw clinicians' attention to a newly described serological technique for the laboratory diagnosis of leprosy and kala-azar, and make observations on the possible use of the test in studying ætiology and epidemiology of the diseases.

*A newly developed technique*

*The antigen.*—This preparation is essentially a solution in benzol of the alcohol-insoluble, pyridin-soluble and acetone-insoluble fraction of human tubercle bacillus (Witebsky, Klingenstein and Kuhn, 1931). A residue is obtained after evaporating benzol and suspended in normal saline. The suspension is standardized and used in a constant dose in the reaction. Different lots of the antigen are compared by their reaction with known dilutions of pooled positive sera. Details of preparation and comparison have been recently published elsewhere (Grevall, Das and Sen Gupta, 1941).

The original antigen, used in the work on leprosy and kala-azar commenced two years ago, was obtained from a European source. The question arose almost immediately whether a satisfactory antigen could be prepared locally. This was necessary before suggestions for the application of the test could be presented to the medical profession. A satisfactory antigen has now been prepared.

*The essential features of the technique.*—The technique has been described in detail elsewhere for leprosy (Grevall, Lowe and Bose, 1939) and for kala-azar (Grevall, Sen Gupta and Napier, 1939; Grevall, Das and Sen Gupta, *loc. cit.*). The essential features are two. (i) The dose of the antigen is linked to the hæmolytic system: it is not anti-complimentary when used with 1 M.H.D. of complement and is not hæmolytic even when multiplied by three. (ii) The reaction is linked to the Wassermann reaction and is put up only when a complement of optimal reaction and titre for the latter reaction is available (Grevall, Chandra and Das, 1940). A Wassermann reaction is done on the

serum at the same time. The quantitative relationship between the serum dilution, the antigen, and the hæmolytic system is the same as in the Wassermann reaction.

The serum is tested in a dilution of 1 in 25 routinely and in other dilutions afterwards, if so indicated and desired. The complement is used in a constant dose of 2 M.H.D. Only one tube is required as a rule: the usual Wassermann control of the 1-in-5 serum dilution if negative or even doubtful, as it generally is, controls this tube also.

Originally the serum was tested for leprosy in a 1-in-5 dilution. Now a 1-in-25 dilution is used for both leprosy and kala-azar.

*The sensitiveness.*—The sensitiveness of the reaction is of a very high order. Like the strongly positive Wassermann reaction of secondary syphilis the reaction cannot be missed or masked by any error or irregularity which is likely to creep into a serological procedure. Because of this high degree of sensitiveness only a complete inhibition of lysis (without a trace of hæmolysis after the tube has stood in the cold overnight) is read as positive.

*The specificity.*—While there is ample excuse for using the term specificity in connection with the reaction of the sera of lepers with the antigen, because of the group relationship between the *M. tuberculosis* and *M. lepræ*, the use of the term in connection with the reaction of the sera of kala-azar patients is not justified. In the latter disease the reaction is undoubtedly non-specific like the Wassermann reaction in syphilis and has probably a similar immunological basis. The diagnostic significance of the reaction, however, is of a very high order.

*The utility.*—(i) In nodular leprosy (recently renamed lepromatous, apparently without regard to the fact that the adjective and the noun are derived from the same source) the diagnostic aid given by the reaction is very good. It has been said that cases of this type of leprosy do not require much aid in diagnosis beyond a microscopic examination of the lesion. The fact, however, remains that taking blood is a much easier procedure than removing bits of tissue for the microscope. Besides, a determination of the end point of the reaction is capable of measuring improvement, spontaneous or resulting from treatment. (ii) In neural leprosy the aid given is not of a high order. (iii) In kala-azar the aid given is even better than in nodular leprosy. Cases in early stages, not detected by formalin test, give strong reactions. Again, taking blood is a much easier process than puncturing internal organs and drilling into bones, and a determination of the end point of the reaction can give useful indication of cure or relapse.

A positive reaction indicates only four possibilities: (1) kala-azar, (2) other form of leishmaniasis, (3) leprosy, and (4) tuberculosis (presumably).

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## CAPILLARIA HEPATICA IN A WILD RAT IN CALCUTTA

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DURING the course of a survey requiring post-mortem examination of a series of rats one rat (*Nesocia bengalensis*) was found in which there were a number of small whitish slightly-elevated irregular areas in the liver. A smear from the cut surface of one of these areas showed large masses of oval eggs with radially

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Observations on the possible use of the test in studying aetiology and epidemiology of kala-azar and leprosy

In the nodular type of leprosy and in all cases of kala-azar the reaction of complement fixation is found to be fully developed and of a high order early in the disease. Is the reaction indicative of a stage in the immunological response of the subject when the hypersensitiveness has developed into an allergic shock? Has this shock been conditioned by extrinsic factors? When does the reaction start? Will it be found at a low level in subjects who are responding immunologically but are not yet stricken, in areas where kala-azar is assuming an epidemic form or in experimental transmission of the disease? How many of them will not be stricken at all? Does the reaction of the known poorly reacting lepers, treated and untreated, rise when seasonal conditions favour leprosy? These are the questions suggested by the reaction. Their bearing on aetiology and epidemiology is obvious.

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[Note.—The authors' claim that this test has a diagnostic value in kala-azar of a very high order is applicable to the original antigen, and has not been confirmed by any published experience with the locally-prepared antigen.—EDITOR, I. M. G.]

# INTRADERMAL TEST AS AN INDEX OF VITAMIN-C NUTRITION OF THE BODY—OBSERVATIONS AT VIZAGAPATAM\*

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and

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AN intradermal test for assessing the state of vitamin-C nutrition of the human body was first described by Rotter (1937), using the dye 2-6-dichlorophenol indophenol. Rotter stated that the decolorization time of the dye was a fair index of the vitamin-C status of the body. If the time was less than 5 minutes, the person was saturated; if the time ranged between 5 and 10 minutes, the person was said to be getting adequate amounts of vitamin C. If the time for decolorization was prolonged beyond 10 minutes, the individual was considered to be suffering from a deficiency of vitamin C. Portnoy and Wilkinson (1938) confirmed the results obtained by Rotter. They also stated that they found a good correlation between the level of blood ascorbic acid and the decolorization time of the intradermal test in 103 patients. Later, Wright and MacLenathen (1939) who also investigated dietary history and determined blood ascorbic acid levels, gave the contrary opinion that Rotter's test was not a reliable

guide for the vitamin-C status of the body. Meanwhile, Sujuki (1939) observed the decolorization time of Rotter's test to be inversely proportional to the ascorbic acid level of blood both in normal healthy human subjects and in pathological states. Beck and Krieger (1939) also considered the test as adequate for all practical purposes.

In India, Banerjee and Guha (1939) investigated how far the test could serve as a correct index of vitamin-C nutrition. In their experiments, the time of decolorization was longest in scorbutic guinea-pigs and was definitely diminished when ascorbic acid was added to the diet of the same animals and was prolonged again by withholding the supplement of ascorbic acid. In human subjects, they found that administration of massive doses of ascorbic acid resulted in reduction of the decolorization time. More recently, Banerjee and Guha (1940) reported again on experiments on guinea-pigs and human subjects, where an attempt was made to find out the minimum decolorization time. They first ascertained the time of decolorization in guinea-pigs and human beings on normal diets. Large doses of ascorbic acid were then administered for some days and the time of decolorization was observed, from day to day, during and after the administration of these massive doses. They noted that, both in guinea-pigs and human beings, the decolorization time became shorter with increasing ingestion of vitamin C and finally they recorded a minimum of 1 minute 20 to 30 seconds. These workers suggest that the minimum decolorization time may perhaps give a truer picture of the vitamin-C status of the body than the common urine (saturation) test.

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striated shell and plugs at either pole bearing a general resemblance to the eggs of *Trichocephalus* except that these were uncoloured. A number of worms were dissected out of the liver tissue by gently teasing the nodules in saline. Unfortunately no complete specimen was secured but one almost whole specimen measuring up to 3 inches was straightened out. These worms had the morphology of *Capillaria hepatica* (Bancroft, 1894) Travassos, 1915. The eggs measured 0.056 mm. to 0.067 mm.  $\times$  0.031 mm. to 0.034 mm.

This parasite is usually found in rats and other rodents. It has also been found as a natural infection in cats, dogs and chimpanzees. According to Baylis (1931 and 1939) a single case of human infection has been recorded in India by Dive, Lafrenais and MacArthur in 1924.

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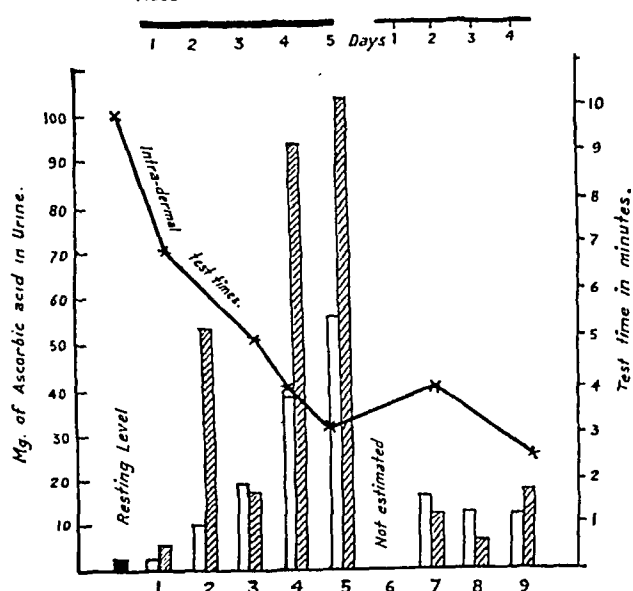
## A preliminary experiment

To acquire first-hand knowledge and experience of the value of the intradermal test and the duration of the decolorization time under certain known conditions we carried out the following tests and observations for a number of days on both of ourselves. At the outset we noted the urinary excretion of ascorbic acid using the simplified method of Harris (1940) and simultaneously noted the time of decolorization of the intradermal test. Then every day a test dose of ascorbic acid (at the rate of 70 mg. per stone weight of body) was administered. The ascorbic acid excreted by the individual in the specimen of urine (collected between the end of the fourth and the seventh hours after injection of the dose) was estimated daily. The intradermal test also was done daily during the same period. In one subject, on the second day of the test dose, 52.5 mg. of the ascorbic acid was excreted. This indicated body saturation according to Harris. A decolorization time which was 10 minutes before the test became shorter gradually. On the fifth day of the test dose, when ascorbic acid excreted in urine was 103 mg. the decolorization time of the intradermal test was 3 minutes 10 seconds. Later, a daily dose of 100 mg. of

ascorbic acid was continued for 4 days and on the ninth day of the test the decolorization time was found to be 2 minutes 30 seconds (fig. 1).

Text-figure 1

Daily test dose of 630 mg. Ascorbic acid at 10 A.M. 100 mg. Ascorbic acid daily at 10 A.M.



- 'Resting level':—Average excretion of ascorbic acid in milligrammes in the specimen of urine between 9 a.m. and 2 p.m., before the beginning of the test.
- Milligrammes of ascorbic acid in the urine excreted daily during the period of the test from 9 a.m. to 2 p.m.
- ▨ Milligrammes of ascorbic acid in the urine excreted daily during the period of the test from 2 p.m. to 5 p.m.

In the other subject also the decolorization time which was 6 minutes 40 seconds before the administration of the drug at the same rate of 70 mg. per stone weight was gradually reduced to 3 minutes 20 seconds on the seventh day of the test. These findings demonstrated that an increased and cumulative intake and utilization of the vitamin C reduces the decolorization time of the intradermal test. We are inclined to believe with Banerjee and Guha that the intradermal test is of value as an index of vitamin-C nutrition of the body. We too consider that the test needs to be standardized and improved.

#### The present investigation

As far as nutritional studies are concerned, Vizagapatam and its environs (situated midway between Madras and Calcutta) may be regarded as an unexplored area. To find out the time of decolorization of the intradermal test in healthy people of different ages, an investigation was started to collect data on the dietary habits of various sections of the population with special reference to vitamin C, doing at the same time the intradermal test on these persons. The test was carried out in two different samples of population: (1) healthy medical students in a fair state of nutrition, (2) elementary school children with no history of

recent illness and no definite evidence of malnutrition. We also attempted to collect similar data on men in the third and fourth decade of life employed in various capacities as clerks, attenders, etc., and on women from lower middle-class families. But as the number of these individuals is not sufficiently large, we hope to present these data at a later date.

#### Technique of the test

The technique adopted for the intradermal test is as follows:—

Twenty mg. of the dye (2 to 6 dichlorophenol indophenol) is added to about 30 c.cm. of hot double-distilled water. The solution is filtered and a sample of it is titrated against ascorbic acid solution of known strength, and the necessary dilution is made in order to obtain a proportion of 20 mg. of the dye in 49 c.cm. of the solution. The solution was taken in a sterilized coloured bottle and preserved in the ice chest. A small drop of the dye solution is injected intradermally so as to raise a weal (2 mm. in diameter) and the time taken for the blue colour to disappear completely is noted by means of a stop watch. An area on the volar aspect of the forearm free from hair and veins was selected for the test. During these investigations, whenever the weal was not satisfactory or whenever there was any slight doubt regarding the result, the individual was subjected to repeated intradermal tests, sometimes at intervals of days.

#### The data collected

The first series (medical students) were living on diets common among the middle-class society of these parts. Some were living in their own homes and taking vegetarian or non-vegetarian diet according to their family traditions. A fair number reside in the medical college hostel where the diet is well balanced, nutritious, and varied. The rest were getting their food from various local hotels. No detailed information was available regarding the types and amount of articles of food consumed from day to day as sources of vitamin C. Almost all were having in their diets some amounts of green vegetables, even the non-vegetarians being accustomed to a mixed diet. The only definite information that could be elicited and relied upon was the intake of citrus fruits. These data afforded a basis of classifying the students according to the amount and frequency of fruit intake into three groups:—

- Group I consists of students who take fruits daily and others who take fruits at least on alternate days.
- Group II includes students who take citrus fruits once or twice a week.
- Group III shows students who either very rarely or never take citrus fruits.

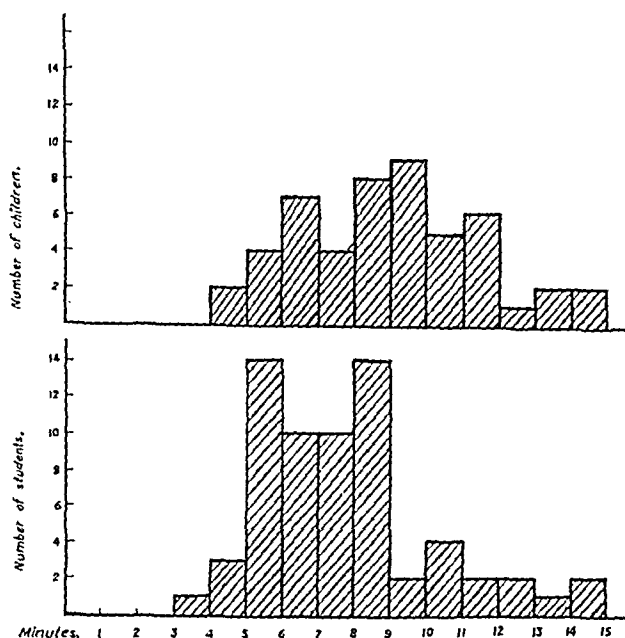
The second series (school children) belong to two representative institutions: one providing instruction for the children of the middle-class society and the other for the children of the poorest class of society. For the performance of the test, we selected only children who had not suffered from any long or acute illness recently and who were also in a fair state of nutrition, as judged by our present physical and clinical standards. In these children, it was



difficult to get a reliable history of intake of fruits but their teachers gave us reliable information that certain pupils belonged to families who stocked and sold oranges and other fruits. These children also stated that they were eating oranges and other fruits regularly, while other children invariably replied in the negative to our queries.

#### *Discussion of the results*

The results of our tests on medical students are summarized in the tables. It will be seen that, according to the standards of Rotter, 83 per cent of all medical students can be said to be normal and that only 17 per cent are in a state of hypovitaminosis C. The largest number of students 48 out of 65 showed decolorization time ranging between 5 and 9 minutes as can be seen from graph 1. Our results therefore are in



Graph 1 showing the number of boys with different intradermal times, ranging from 3 to 15 minutes.

general agreement with those of Rotter. We have therefore taken the same range of decolor-

With regard to school children, the decolorization times range between 4 minutes 10 seconds and 14 minutes 30 seconds with an average of 8 minutes 50 seconds as compared with the average of 7 minutes 45 seconds for medical students. Applying Rotter's standards to these children, it will be noted that 70 per cent can be declared normal while 30 per cent have to be judged to be in a state of hypovitaminosis C. On further examining, the data at our disposal on the social and economic condition of the families from which these children come a significant difference is noted. In the school for middle-class society only 20 per cent of the children record decolorization time above 10 minutes whereas in the school for the poorest classes of society the figure rises to 37 per cent. In the middle-class children the decolorization time ranged between 4 minutes 10 seconds and 11 minutes 40 seconds with an average of 8 minutes 12 seconds while the children from the other school recorded decolorization time ranging between 4 minutes 40 seconds and 14 minutes 30 seconds with an average of 9 minutes 15 seconds. But even these figures do not really and correctly represent the position in the poorest classes. As many as 8 out of the 30 in the school for poor children came from families of fruit-sellers and were actually eating fruits regularly. If the decolorization time of these 22 children are considered separately they range between 6 minutes and 14 minutes 30 seconds with an average of 10 minutes 20 seconds. This is the longest time of all the averages for different groups. The percentage of hypovitaminosis C is as high as 50 per cent in this limited but representative sample of population from the poorest strata of society. It may be pointed out here that the percentage of hypovitaminosis among the medical students as well as the school children of middle-class society is almost the same, i.e., less than 20 per cent, while the percentage among the poorest classes is as high as 50 per cent.

There were no significant variations among different age groups or sexes in the elementary school children.

TABLE I

Age	Number of students	Range of decolorization time				Average time		Incidence of hypovitaminosis, per cent
		mins.	secs.	mins.	secs.	mins.	secs.	
6-8	16	6	30	to	11 30	9	5	25
8-10	16	4	10	to	14 30	8	36	31
12-14	18	4	40	to	14	8	47	33

ization time, 5 to 10 minutes, as enough indication of adequate intake and utilization of vitamin C by the individual.

Ten girls with ages ranging between 8 to 10 years showed decolorization time between 5 minutes 30 seconds and 14 minutes and 30

seconds, and an average time 9 minutes 48 seconds. The only interesting finding here is that nearly 50 per cent were in a state of hypovitaminosis. It must be added here, however, that all these girls belong to the poorest class of society. Girl students of the medical college recorded decolorization time between 3 minutes 45 seconds and 12 minutes 45 seconds with an average of 7 minutes 7 seconds. And only 13 per cent were in a state of hypovitaminosis. Though all of them came from middle-class families, they were no doubt the most favoured children in the family.

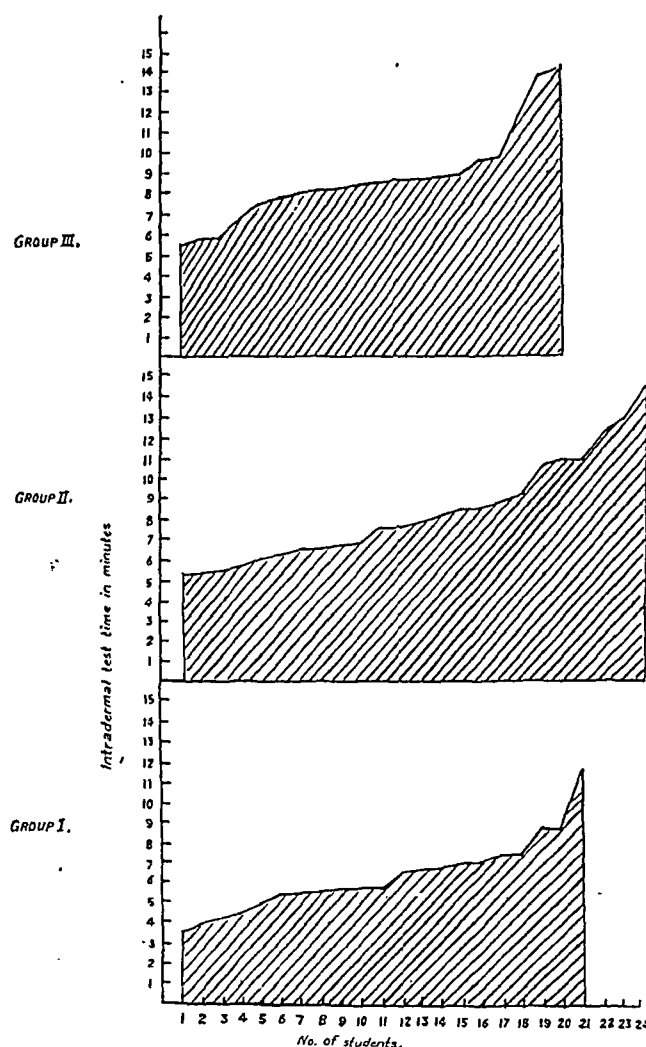
The amount of vitamin C ingested in the diet or as supplement is not always easy to determine by ordinary questioning regarding the kinds and quantities of foodstuffs supposed to be provided. Even a personal examination of quantities of foodstuffs actually served is not free from fallacies. The students do not eat all that is served, nor do they eat the same proportion of the article every day. As has been already stated, almost everybody says he takes greens and vegetables. But how much of it and how frequently is not definite. Hence we classified all the subjects examined into 3 groups, according to their consumption of citrus fruits. The effect of vitamin-C supplement in the form of fruits is obvious from a perusal of graph 2. The range of decolorization time among medical students taking fruits is between 3 minutes 45 seconds and 11 minutes 38 seconds, and the average 6 minutes 21 seconds. Among the school children also who take fruits regularly the decolorization time ranges between 4 minutes 40 seconds and 8 minutes 10 seconds, with an average of 6 minutes 16 seconds. In our whole series, we had 30 persons who were taking fruits regularly. In this group only one gave a decolorization time of more than 10 minutes, and in this case we have no means of verifying the statement about the consumption of fruits. In the course of our examination of medical students and elementary school children, we came across two interesting findings. The decolorization time in one medical student was 7 minutes 15 seconds on the first examination. He began to take Batavian oranges daily. After three weeks, his decolorization time fell to 3 minutes 30 seconds. The elementary school children coming from the families of fruit-sellers invariably recorded a shorter decolorization time than the rest.

### Conclusions

1. The intradermal test is a simple but fairly reliable test of the vitamin-C status of the body. Its chief merit is that it can be used in public health work as well as in schools and hospitals where the elaborate methods of determining blood ascorbic acid level or of doing urinary saturation tests cannot be carried out easily and on a large scale.

2. Young adults and school children who are eating citrus fruits regularly or those who were

getting an all-round mixed diet recorded decolorization time generally within 10 minutes. Rotter stated that individuals showing a decolorization time of less than 10 minutes may be considered to be getting adequate amounts of vitamin C in their diet. The same standard, namely, 10 minutes, may be provisionally adopted to differentiate the subjects getting adequate doses of vitamin C from those who are in a state of sub-clinical hypovitaminosis.



Graph 2 showing the distribution of intradermal test times in students.

- Group (i). Students taking fruits at least on alternate days as a vitamin-C supplement to their diet.
- Group (ii). Students taking fruits at least once a week as a vitamin-C supplement to their diet.
- Group (iii). Students either taking fruits very rarely or not taking fruits at all.

3. The incidence of hypovitaminosis C in various groups of young adults and school children has been investigated using the intradermal test and Rotter's standards. Among middle-class students the incidence of hypovitaminosis C is less than among the children of the poorer classes.

4. As far as young adults and children are concerned age, sex, etc., do not seem to have

TABLE II

	Total number of students on whom the test was done	Test time within 5 minutes	Test time between 5 and 10 minutes	Test time over 10 minutes	VITAMIN-C SUPPLEMENT		
					Group I	Group II	Group III
1. Number of students	65	4 (6%)	50 (77%)	11 (17%)	21	24	20
2. Range of decolorization times in them.	3' 45" to 14' 20"	..	..	..	3' 45" to 11' 38"	5' 8" to 14' 20"	5' 30" to 14' 0"
3. Average time of decolorization.	7' 45"	..	..	..	6' 21"	8' 11"	8' 41"
1. Number of male students	50	1 (2%)	40 (80%)	9 (18%)	11	19	20
2. Range of decolorization times.	4' 15" to 14' 20"	..	..	..	4' 15" to 11' 38"	5' 8" to 14' 20"	5' 30" to 14' 0"
3. Average time of decolorization.	7' 56"	..	..	..	6' 58"	7' 42"	8' 41"
1. Number of lady students	15	3 (20%)	10 (67%)	2 (13%)	10	5	Nil
2. Range of decolorization times.	3' 45" to 12' 45"	..	..	..	3' 45" to 7' 30"	8' 0" to 12' 45"	..
3. Average time of decolorization.	7' 7"	..	..	..	5' 40"	10' 2"	..

any appreciable influence on the vitamin-C requirements of the body.

#### Acknowledgments

It is a pleasure to thank the officers of the Vizagapatam Municipality who readily afforded facilities to examine children in the municipal schools. Our thanks are due to Mr. P. V. Krishnamurthy and Mr. M. V. Tirumal Rao of the department of chemistry, for their unstinted help in laboratory work. We are grateful to Dr. N. Alahasingari, Professor of Physiology,

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## A Mirror of Hospital Practice

### A CASE OF BACILLARY DYSENTERY SIMULATING ACUTE ABDOMINAL CATASTROPHY IN ITS EARLY STAGES

By R. J. SINHA

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and

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D. R., aged 30 years, Hindu male, was admitted into the Mudidih Colliery Hospital of Messrs. Bird and Company on the 22nd February, 1941, with the following complaints:—

- (1) Severe pain in the abdomen since last evening.
- (2) Vomiting of bilious material since last evening.
- (3) Retention of urine since last night.

On enquiry it was discovered that the patient had eaten the roasted skin of a goat two days before his admission into the hospital. He was feeling out of sorts on the day before admission and in the evening

severe griping pain in his abdomen with bilious vomiting began. He had no stool and passed no flatus during the previous 24 hours. He has not passed urine since the night before.

*Examination.*—The patient was thinly built, anæmic and looked ill. Temperature—99°F. Tongue—coated and dry, eyes sunken with dark rings under them. Pulse rate—110 per minute.

The abdomen was soft, slightly distended and tender all over. Tenderness was especially marked in the hypogastric region. The bladder was full, the liver and the spleen were not palpable. Liver dullness was not obliterated. Rectal examination revealed no abnormality except general tenderness. Prostration was marked. Blood count showed leucocytosis with 86 per cent polymorphonuclear cells.

By way of treatment it was decided to (a) combat the toxæmia, (b) relieve the bladder and (c) stop irregular peristalsis and hence griping.

To relieve the toxæmia 50 c.cm. of 25 per cent glucose solution was injected intravenously and saline given per rectum by the drip method.

To relieve his bladder he was catheterized and a small quantity of pus came out at the beginning, showing that the cause of retention was partly local.

To allay griping he was given tincture hyoscyamus one drachm with tincture belladonna 15 minims in an ounce of water repeated every 6 hours, guided by the size of the pupil.

On the following day there was no improvement in the clinical picture, the temperature went up to 101°F. and it was decided that the patient should be given a high soap and water enema with asafœtida. The result of the enema was that some flatus together with faecal matter came out and the patient was slightly relieved. He was given 50 c.cm. 25 per cent glucose solution intravenously, and the hyoscyamus mixture was continued.

Next morning, there was a well-marked mass in the left iliac region, and tenderness was marked in the right iliac fossa as well. It was thought to be impacted faecal matter and a high enema with soap and water preceded by olive oil and glycerine was given; the result was that a lot of faecal matter came out and the mass disappeared. The patient now began having frequent loose motions (20 to 25 a day) and the griping continued.

He was now given castor-oil emulsion thrice daily with the result that the frequent loose motions continued but the pain became much less in intensity.

On the 7th day of the disease the castor-oil emulsion was stopped, and the following day the patient started having the griping pain and loose motions with mucus and blood.

Microscope examination of the stool revealed pus cells in large number, large number of red cells lying discrete and macrophage cells.

No *Entamoeba histolytica* was found, but there were plenty of bacteria (it was the 8th day of the disease).

A diagnosis of bacillary dysentery was made and Shillong bacteriophage was administered, one ampoule every 4 hours.

The stools quickly improved, the pain became much less, the patient began to feel better and in 3 days' time he was passing almost normal stools once a day and eating his food.

He was kept on a saline mixture with belladonna thrice daily.

### Discussion

The interesting features of this case are that it resembled a case of acute abdominal catatroph at the onset and it was only after a time, when the obstruction of the gut was removed, that the actual condition was discovered.

The questions that might be raised are :—

(1) What was the obstruction to the large gut due to? Was it (a) toxic paresis of the muscles of the large gut? (b) obstruction by scybala? or (c) any other type of obstruction that was removed by enema?

(2) Was it a case of bacillary dysentery from the beginning?

From the case notes it is obvious that the patient was markedly toxic, as shown by the rise of temperature, signs of dehydration and prostration. The leucocytosis combined with the clinical picture is in favour of some inflammatory condition within the abdomen. The absence of rigidity eliminates the possibility of such conditions, as appendicitis, cholecystitis, etc.

The scybala were neither hard nor large enough to account for the obstruction to the lumen of the gut.

The stool examination showed definite evidence of an acute inflammatory condition within the large gut and the microscopic picture was that of acute bacillary dysentery.

Combining all the above facts the diagnosis of bacillary dysentery seems to fit in best and it is corroborated by the condition disappearing with phage therapy.

Our explanation of the clinical manifestations of obstruction is as follows :—

The initial toxæmia due to infection by the organisms of bacillary dysentery caused a paresis of the large gut which resulted in inability to expel the faecal matter and flatus. The distension could not increase much because of early attempts to relieve the obstruction by compound enemata.

On the removal of the infected mass, containing a large amount of toxins of the organisms by enema and subsequently by castor-oil emulsion, the clinical picture improved and again became worse when the emulsion was omitted.

Bacteriophage cured the condition by eliminating the organisms and thus stopping the further formation of toxins.

Our thanks are due to Messrs. Bird and Company and the Chief Mining Engineer, Mr. Tarlton, for kindly granting us permission to report this case.

### ECLAMPSIA TREATED WITH INTRA- VENOUS INJECTION OF MAGNESIUM SULPHATE SOLUTION

By S. K. ROY, B.Sc., M.B.

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Midnapore

(1) DATE of attendance—31st August, 1939. Patient—age about 15 years.

The patient was seen after she had 4 to 5 fits in the course of half an hour. She was at full term. Œdema present all over the body. Stroganoff's treatment was immediately started and 50 c.cm. of 25 per cent glucose solution was also injected intravenously. The interval between fits was lengthened but they could not be stopped even after treating the patient for 13 hours, and the number of fits was 22 up till then. Then 15 c.cm. of 10 per cent magnesium sulphate solution was injected intravenously and there was another fit after 5 hours, after which 10 c.cm. more of the solution of magnesium sulphate was given intramuscularly. After this there were no more fits. A few minutes after the second injection there was spontaneous delivery of an asphyxiated child which was resuscitated in 15 minutes. The patient and child are living and healthy.

(2) Date of attendance—30th April, 1940. Patient—age about 17 years.

The patient was seen after she had had 10 to 12 fits in very quick succession. The patient had much œdema all over the body and was comatose even during the interval between the fits. Stroganoff's treatment was immediately instituted and even after 3 hours the fits were coming in as quick succession as before. Then 15 c.cm. of 10 per cent magnesium sulphate solution was injected intravenously, there was a lengthening of interval between the fits but they did not stop. The delivery of the child was hastened by forceps but the patient died an hour later.

(3) Date of attendance—16th December, 1940. Patient—age about 17 years.

The patient was seen after she had 3 to 4 fits. She had no œdema anywhere. Stroganoff's treatment was started and 25 c.cm. of 25 per cent glucose solution was injected intravenously. After 13 hours, though the interval between the fits was lengthened they could not be stopped. Another 25 c.cm. of glucose solution was injected followed by 15 c.cm. of 10 per cent magnesium sulphate solution intravenously. After this injection

there were no more fits and a dead child was born spontaneously 2 hours after the appearance of 'show'. The patient had restlessness for another 24 hours and 10 grains of chloral hydrate in 4 ounces of 2½ per cent glucose solution was given per rectum every 4 hours. The patient was cured and is alive and well.

(4) Date of attendance—7th March, 1941. Patient—age about 14 years.

Full term of pregnancy. Having pains for the last three days. No oedema anywhere. I saw the patient 3 hours after the appearance of the first fit, and in the course of these 3 hours there were altogether 6 fits. I gave 50 c.cm. of 25 per cent glucose solution intravenously and then 15 c.cm. of 10 per cent magnesium sulphate solution intravenously. Immediately after the last injection there was a fit. Six hours later there was a fit but the duration was very short. A few minutes after this fit there was spontaneous birth of a dead child. Four hours after the injection of magnesium sulphate solution 10 grains of chloral hydrate in 4 ounces of 2½ per cent glucose solution was administered per rectum every 4 hours. The patient recovered.

In the same period I had 3 other cases of eclampsia :—

(1) *Postpartum eclampsia*—in which case the fit stopped after the first injection of morphine and Stroganoff's treatment was carried out all through. The patient recovered.

(2) Eclampsia at the full term of pregnancy. The patient was extremely swollen with very scanty urine exactly like case 2 above. Morphia and chloral treatment was given but the fits could not be stopped in 6 hours. After that, delivery took place assisted by forceps but the patient died a quarter of an hour after delivery.

(3) Eclampsia at the full term of pregnancy. Patient's age was about 18 years. No oedema anywhere. Stroganoff's treatment was instituted and the fits were stopped in 8 hours. Delivery of a dead child took place 3 hours later, assisted by forceps.

All the cases treated were primigravidae.

*Discussion.*—The number of cases treated is too small to give a definite opinion regarding the value of treatment either by Stroganoff's method, by magnesium sulphate alone or by combined treatment.

It seems that suitably selected cases may better respond to magnesium sulphate treatment combined with intravenous glucose and venesection where the blood pressure is high, and chloral hydrate if there be irritability.

Patients treated by magnesium sulphate seem to be more generally delivered spontaneously than the cases treated by morphia and chloral, in many of which forceps are required.

## EFFECT OF SULPHAPYRIDINE ON ROUNDWORMS IN A CHILD WITH PNEUMONIA

By H. L. HALA, L.C.P.S. (Bom.)  
Mission Hospital, Ratlam, C. I.

A BOHRA child, aged two years, was brought to the out-patients' department, Mission Hospital, Ratlam, with cough and fever, duration six days. General examination showed marked anæmia and rickety changes. Both lungs were affected with bronchopneumonia, and the abdomen was distended.

Following treatment was given:—(i) Sulphapyridine, half tablet every four hours for two days and in reduced doses for successive five days, (ii) stimulant cough mixture every four hours, (iii) sugar solution by mouth frequently, (iv) mustard oil to the chest and back every four hours, and (v) glycerine enema with good result but without any effect on distension. Admission of the child into the hospital was also advised.

The following day the father came to me with a cigarette tin full of roundworms. The patient passed

148 roundworms on three successive days. After two days, as the temperature came to normal, sulphapyridine was reduced; gradually the condition improved. After two weeks the patient looked fairly well and the pot-belly disappeared; no anthelmintic was given. The stool was examined; it showed no ova of roundworms. The child is improving on anti-rachitic therapy and iron mixture.

I would suggest that some experimental work be done in this connection, as we have found in practice the treatment with santonin in some cases unsatisfactory.

In conclusion, my thanks are due to Dr. W. G. Anderson, physician-in-charge of Mission Hospital, Ratlam, for kindly allowing me to publish this note.

## A CASE OF DISPUTED PARENTAGE

By G. P. CHARLEWOOD, M.B., Ch.B., M.R.C.O.G.  
CAPTAIN, I.M.S.

Civil Surgeon, Coorg

THE following case was unusual, in that the maternity, as well as the paternity of a child was under dispute. The case was heard in the Criminal Court in Mercara on 10th June, 1941.

Kengappa and his wife Chennamma claimed that their four-year-old son had been kidnapped a year previously by Syed Fakir and his wife Fathima Bee, who however stated that the boy was their own. They pointed to the fact that Fathima Bee was feeding the child on the breast.

Blood examinations of the 'A B O' variety were conducted on all four 'parents' and the child. It was found that the child and Fathima Bee were group A (or group 2, Moss). Her husband, Syed Fakir, and both Kengappa and Chennamma were all group O (4 Moss) showing that the child could not belong to Kengappa and Chennamma and that the charge of kidnapping was false.

The magistrate decided the case entirely on the results of the blood test. Indeed no other evidence of any value was forthcoming.

The case is interesting because the ordinary A B test is generally held to be hardly worth trying since it gives so few definite results (Lynch and Harley, 1938). Where, however, the maternity as well as the paternity is in dispute, as in the above case, the chances of a definite result from this test are obviously greatly increased.

There is approximately a 30-per-cent chance of proving non-paternity where the M N test is used in addition to the A B test (Lynch and Harley, *loc. cit.*). But where the maternity is also in doubt this figure would also be greatly increased.

## REFERENCE

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## CORRIGENDA

### MULTIPLE PRIMARY EPIDERMOID CARCINOMA: DE AND TRIBEDI

In the above-mentioned paper which appeared in our July issue, on page 398, first column, the 31st line from the bottom which reads 'nature with marked differentiation (figures 4 and 5)' should read 'nature with marked dedifferentiation (figures 4 and 5)'. The same mistake also occurs in plate XX, figure 5, case 1, second line of letterpress which should read 'magnification to show the marked dedifferentiated condition'.

# Indian Medical Gazette

AUGUST

## THE PUBLIC HEALTH SECTION

IN an editorial in our April number last year we attempted to trace, in the barest outline, the evolution of medical science from the time when primitive man depended entirely on instinct for both treatment and prevention, to the present day. During any 'civilized' period in the world's history, when sane men have been allowed to follow sane thoughts, the tendency has always been towards prevention; in the dark ages, when the individual ceased to look for anything good from his rulers and in return gave as little as he could and that grudgingly, it was a case of every man for himself; man sought medical relief from wherever he could get it, and prevention, except in so far as it could be practised by the individual for himself or his family, was forgotten. It was in this environment that our present 'system' of scientific medicine was born and the foundations of medical education laid, and whilst, in practice, medicine in all progressive countries of the world is steadily emerging from this stage, medical education is lagging behind.

The organization of preventive medicine is essentially a matter for the state. In this organization there are, broadly speaking, two schools of thought, the democratic and the totalitarian. In the latter, rules and regulations that are sound in principle but are often totally opposed to the inclinations and upbringing of the people on whom they are imposed are laid down, and on the face of it enforced; whereas, the democratic way is first to explain to the people the reasons for giving up certain practices or adopting others, and then, when if not a majority at least an appreciable and influential minority have grasped the importance of the matter, to introduce legislation with a considerable number of loop-holes, which, as the advantages of the legislation are gradually understood by the people, are closed one by one. We are not prepared to be dogmatic about which is the best method; on paper the totalitarian way is the most efficient, but its success will depend on the attitude of the people towards the state; if they worship it, as we are led to suppose that they do in the totalitarian states, then their system probably works best. In democratic countries, this system does not work and whenever it has been tried it has proved a failure.

In India we follow the democratic system and must therefore start by educating the people in the advantages of preventive methods, which can only be done by first educating the medical

profession, and this brings us up against a serious defect in our present system of medical education.

We wrote in our previous editorial that it would be more rational if the medical student were given a thorough training in the general principles of medicine and in the practice of preventive medicine before his qualifying examination; those who wished to specialize in clinical medicine could then take a post-graduate course in this subject. We repeat that this would be more rational than the reverse which is the present procedure, but we agree that it would not be practical under present-day conditions. A change, however, both in the curriculum and in the outlook of the teacher of medical subjects is urgently required; perhaps the latter change is the more important, and it is the one with which we ourselves are mainly concerned.

In the average textbook on medicine, only a few lines are devoted to the aetiology of the disease and the references to prevention are usually of the most perfunctory nature. It is little wonder that the student learns to concentrate on the patient himself and not to consider him also in his relationship to the community. The practitioner's first duty is to make a diagnosis, for this has an important bearing on both treatment and prevention but often a more vitally important one on the latter. His second thoughts should be for the community; whether the disease is likely to affect others and if so what can be done to reduce the chances of this happening? After this he can turn to the treatment of his patient. We fear that these second thoughts are often omitted, or, if they arise, amount to little more than wondering if there are any irksome regulations which have to be complied with.

The reason for this attitude of the average practitioner towards prevention is primarily that he has not been taught to think otherwise, but it is also fostered by the present artificial division of the medical services into the curative and preventive sides; when there are others paid to prevent disease, there are many practitioners who honestly believe that their duties end when they have prescribed for their patient.

This journal has always included preventive medicine within its scope, and few numbers have been published that do not contain at least one original article directly or indirectly concerned with prevention of some special disease or of disease generally. In other sections of the journal also, we have given space to subjects mainly concerned with prevention; for example, by arrangement with the Tuberculosis Association of India, we have published nearly every month for some time a short item under the heading 'Tuberculosis News'. This of course includes reference to treatment, but in this, as well as in a number of other diseases, the treatment of the individual is a very



important means of preventing the disease in the community, and it is from this point that the subject has been viewed.

We propose in future to include a public health section in each number of this journal. In it we hope to publish editorial notes, original articles, résumés of papers from other journals, extracts from reports, items of news, etc., on subjects of public health interest, under the headings, nutrition, microbiology, epidemiology, maternity and child welfare, sanitation and sanitary engineering, and public health administration, and on the public health aspects of such diseases as tuberculosis, malaria, and leprosy.

This segregation of the subject of public health may seem contrary to our claim regarding the unity of purpose and indissolubility of medical science. Nevertheless, we feel that it will serve the purpose of focusing the attention of the practitioner on the importance of public health work, and it is for him rather than for the professional sanitarian that this section is

being started. It is however to the latter that we look for assistance to make this section a success, and before undertaking it we assured ourselves of the co-operation of the director and staff of the leading sanitary institution in this country, the All-India Institute of Hygiene and Public Health. They have agreed to help us with the collection and arrangement of material for this section. However, as in the case of the special tuberculosis number, in the publication of which we receive the assistance of a committee of the Tuberculosis Association of India, the final responsibility for the section remains with the editor of this journal.

This new section will be placed in the second half of the journal and will not encroach on the pages devoted to original articles, although original articles will be included in the public health section. Our conservative readers therefore need not feel that they are losing anything, and our progressive ones will, we hope, consider that they are gaining by this change.

## Special Article

### NOTES ON THE TRAINING OF ATHLETES

By S. A. SUBEDAR, L.C.P.S., R.M.P.

*Kutiyana, West Kathiawar*

I HAVE read with considerable interest the articles and correspondence in the *Indian Medical Gazette* on doping in sport. The intimately associated subject of training of athletes is one which has not received the attention from medical men that it deserves and I hope that the following résumé of an article in the *Medical Annual* of 1937 by Dr. Adolphe Abrahams, M.D., F.R.C.P., may be of interest to medical men in India. For the sake of convenience of readers, quotation marks have been omitted.

The application of scientific principles to the practice of training of the body for specially severe exertion is of comparatively recent date. Strenuous competitive exercises, i.e., boxing, rowing, walking, were confined to the lower classes as professional exploits. The so-called principles of training were applied with brutality which seems almost incredible to us at the present time.

When athletic enterprises became fashionable, the youths of the period imitated their methods and adopted their system of rules and regulations. For a time the training remained in the hands of the arbitrary professional whose methods constituted an ordeal from which even the bravest might turn with a shudder.

The medical profession claims to have been responsible for a better understanding of the rationale upon which the physical perfection of the human body depends. The medical profession has tried to explain that the laws of physiology apply with particular reference to

the subject of training. With gradual elimination of sheer brute force from many feats of exertion, the introduction of skilled co-ordinated movements has encouraged the aspirants to athletic distinction as highly specialized individuals rather than as crude mass-produced machines upon which almost any sort of system might be imposed. More and more the part which the medical profession is called upon to play is demanded by the increase in the love of sports, in realizing the fact that exercise occupied an important position in modern education and the extension of international competition all over the world.

#### *Diet in training*

Prejudice is always difficult to overcome and particularly in regard to dietetics in training; the old-fashioned and well-established fetishes will be the last to disappear. The fundamentals are readily comprehended. They are based upon experiments and investigations. It is easy to understand that no article of food can possess specific properties to produce or increase respiratory power or circulatory efficiency. Energy, stamina, strength and endurance are obtained by efforts. So long as essentials are provided and the food is suitable to the digestive organs and agreeable to the palate, it matters very little in what form they are taken.

Any food which is a source of energy is good for training. During violent exercise much energy is required for the muscular effort. The heart and the lungs should not be embarrassed by improper and injudicious meals at unsuitable times. Our predecessors appreciating that overcooking hardened the fibres of meat, ate it raw. Such injunctions led to a nauseating regime which produced staleness, boils and other

minor illnesses too frequent during the training of the past, and, although rare, not altogether absent at the present day.

*Quantity of food.*—The only guide to the quantity of food which an athlete should consume is the natural appetite. To eat beyond the requirement of appetite is a gross error. Every particle of food thus eaten becomes an encumbrance, hindrance, and a loss. To consume large quantities of animal proteins, on the mistaken belief that strength is acquired, is a grave error. Long distance cyclists take astonishingly small quantities of food. This leads us to the conclusion that eating is often a matter of habit.

*The choice of food.*—The more we study the methods of the greatest athletes, the more we are struck with their simplicity. The normal selection is a mixed diet according to the taste, opportunity, or status of the individual. The advantages of animal proteins over vegetable proteins require no emphasis. Yet it is a question whether any virtue is possessed by the proteins of meat over those of milk, eggs, cheese. With ethics we are not concerned. A large number of athletes eat and prefer meat. There are great vegetarian athletes also. It is therefore foolish to assert that all athletes should follow a particular rule in matter of diet.

Recently, the value of carbohydrate as a muscle food has assumed importance and the practice of taking sugar a short time before a contest is harmless. In the case of very prolonged efforts, such as a 100-mile run or a 12-hour cycle race, the athlete will be well advised to take only meat sandwiches of small bulk or a solution of glucose, remembering also that the loss of water from the body should be replaced by common salt solution. Experiments have given support to the impression that vitamin B and fat in small quantity should be included in the diet.

*Liquids.*—An idea to a certain extent persists that liquid in any form is bad for training. It is very simple to explain that violent exercise is accompanied by considerable loss of water through the skin and unless this water is replaced regularly the athlete will suffer from insufficiency of lubrication. Liquid in training is not only harmless, but a liberal supply is beneficial, provided it is not taken in excess at meal times. Enough should be taken to make the meal enjoyable, but not more. Larger quantities are beneficial when taken on an empty stomach, on rising, between meals and at night.

*Alcohol.*—Alcohol is quite unnecessary in training. The vast majority of athletes are total abstainers. Alcohol has its limited use as a medicine. It is the practice during the full training of the university crew to allow champagne occasionally to instil a spirit of cheerfulness and to mitigate over-anxiety which prevails in the circumstances.

### *Tobacco*

In training it is inadvisable to change a man's habits; emphasis should not be laid upon the prohibition of smoking. It is not easy to compare the capabilities of smokers and non-smokers. Experiments have been conducted which appear to indicate the baleful effects of tobacco upon physical efficiency, for example the disadvantages of carbon monoxide in inhaled smoke, the effects on the nervous system, or the direct action on the heart. But the restlessness, sleeplessness, irritability and other disturbances which often follow withdrawal of tobacco should not be forgotten. The young athlete should be encouraged to abstain from tobacco as much as possible. It is good to be more tolerant. There are great track athletes who smoke up to the last moment of going to the track. Long distance cyclists are invariably non-smokers, not because they believe they suffered, but because they were not interested.

### *Sleep*

This depends on the individual. The old idea that half of 24 hours should be spent in bed has no justification. Sleep of seven or at most eight hours should be recommended. Injunction to go to bed early should be enforced to avoid late hours which are not good for training. To bed at 10 or 10-30 p.m. rising at six or 6-30 a.m. with a little physical exercise or some mental occupation before breakfast is the best rule.

### *Drugs*

Old time training consisted of strong emetics and strong purgatives. Nowadays drugs are rarely employed. Their use is only guided by the necessity of the moment. Patent medicines are useless. Their benefit is only suggestive. The doping habit which is prevalent in some part of the continent should be condemned.

### *Physical fitness and staleness*

A distinction ought to be drawn between training and coaching. The preparation of an athlete for a contest requires him to be brought to the acme of physical perfection. Co-operation between the coach and the trainer is the best procedure. The condition of physical fitness and that of staleness are associated. When an athlete goes stale, the change is so profound as to lead us to the conclusion that some constitutional disturbance has occurred. His nervous system is deranged. He is dejected, peevish, irritable, sleeps badly, loses his appetite, and loathes the track and anything connected with it. His capabilities deteriorate. He is inferior to an untrained man. This can be attributed to the monotony of life, diet, society, and conversation. In the highly strung athletes this induces 'brain fog'.

If staleness should occur complete rest from the track and from everything connected with it should be advised. This will restore the

mental balance in a few days. Change of food will also contribute to the cure. It is desirable to give rest to the digestive organs by giving invalid diet. A small dose of calomel should be given. Weight is the guide which leads us to the suspicion of staleness. A continuous loss of weight must be regarded as a danger signal. Change in the rate of heart beats is another guide. The athlete should be exerted for a period of 20 seconds. After the cessation of exertion if he does not regain his former pulse rate within 40 seconds, he is unfit. Searching inquiry must be made not forgetting the psychological aspect.

## Medical News

### INDIAN MEDICAL BIRTHDAY HONOURS, 1941

The following are the names of medical men and others associated with medical institutions in the Indian Honours List of date 12th June, 1941. We offer them our congratulations:—

#### K.C.I.E.

Lieutenant-General G. G. Jolly, I.M.S., Director-General, Indian Medical Service.

#### C.I.E.

Major-General H. Stott, I.M.S., Surgeon-General with the Government of Madras and lately Inspector-General of Civil Hospitals, Bihar.

Lieutenant-Colonel C. M. Ganapathy, I.M.S., Director of Public Health, Madras.

Lieutenant-Colonel G. Verghese, I.M.S., Director of Health and Inspector-General of Prisons, Orissa.

Lieutenant-Colonel C. M. Nicol, I.M.S., lately Director of Public Health, Punjab.

Lieutenant-Colonel M. A. Nicholson, I.M.S., Chief Medical Officer in Central India and Residency Surgeon, Indore.

#### O.B.E.

Lieutenant-Colonel J. M. R. Hennessy, I.M.S., Civil Surgeon, Jubbulpore, C. P. and Berar.

Major F. A. B. Sheppard, I.M.S., District Medical Officer, Madura, Madras.

#### M.B.E.

Miss Elizabeth Isabel Hamilton-Browne, w.m.s., Lady Assistant to the Inspector-General of Civil Hospitals, Punjab.

P. T. J. Doss, Esq., Medical Officer of Health, Secunderabad Cantonment, Hyderabad (Deccan).

B. S. Parsram, Esq., Medical Officer, R. B. Udhavdas Tarachand Hospital, Shikarpur, Sind.

#### Kaisar-i-Hind Gold Medal

Mrs. Lydia Torrance Allen, Superintendent, Lady Dufferin Hospital, Calcutta.

Miss Margaret Duncan Salmond, Lady Willingdon Leper Settlement, Tirumani, Chingleput, Madras.

#### Kaisar-i-Hind Silver Medal

Miss Mary Harding, lately Matron, Lady Reading Hospital, Peshawar, N.-W. F. P.

Miss Eileen Spencer Morris, Medical Superintendent, St. Stephen's Hospital for Women and Children, Delhi.

Miss Hope Nicholson, Doctor-in-charge, Jackman Memorial Hospital, Bilaspur, C. P. and Berar.

Miss Aileen Barter Snow, Medical Officer in charge of the St. Catherine's Hospital, Amritsar, Punjab.

#### Kaisar-i-Hind Bronze Medal

Miss Mary Augusta Beetles, Senior Sister, Patna Medical College Hospital, Bihar.

#### Diwan Bahadur

Captain Rao Bahadur P. K. Ayyar, Civil Surgeon (retired), Madras.

#### Sardar Bahadur

Sardar Sahib B. H. S. Grewal, in charge Civil Hospital, Goira, Lyallpur, Punjab.

#### Rai Bahadur

A. P. Bajpayee, Esq., Civil Surgeon, Bijnor, U. P.  
Rai Sahib R. P. Ghosh, Civil Surgeon (officiating), Manbhum, Bihar.

#### Rao Bahadur

G. R. D. Rau, Esq., Principal, Stanley Medical College, and Superintendent, Stanley Hospital, Madras.  
Rao Sahib K. V. Chipkar, Civil Surgeon, Bijapur, Bombay.

S. J. Eapen, Esq., District Medical Officer, M. & S. M. Railway, Guntakkal.

#### Shifa-ul-Mulk

Hakim A. Laatif, Vice-Principal, Tibiya College, Moslem University, Aligarh, U. P.

#### Sardar Sahib

Sardar T. Singh, Medical Practitioner, Loralai, Baluchistan.

Sardar S. Singh, Sub-assistant Surgeon, Baluchistan.

#### Khan Sahib

A. Majid, Esq., Civil Surgeon (officiating), Rajshahi, Bengal.

M. K. Kakarzal, Esq., Municipal Medical Officer of Health, Budaun, U. P.

Shaiikh A. Karim, Senior Sub-assistant Surgeon-in-charge, His Excellency the Governor's Dispensary, Punjab.

Sayid A. Hasib, Assistant Surgeon, Bihar Sub-divisional Hospital, Patna.

#### \*Rai Sahib

R. K. Arora, Esq., District Medical Officer of Health, Jaunpur, U. P.

N. C. Sinha, Esq., Assistant Surgeon, Muzaffarpur, Bihar.

C. N. Banerjee, Esq., Superintendent, Vaccine Depôt, Namkum, Ranchi, Bihar.

K. Singh, Esq., Lecturer in Midwifery and Gynecology, King Edward Medical School and in-charge of Maternity and Gynecology Wards, King Edward Hospital, Indore, Central India.

#### Rao Sahib

W. A. Phaturfod, Esq., Port Health Department (on deputation), Bombay.

### STAINS FOR MEDICAL WORK OF INDIAN MANUFACTURE

SEVERAL essential stains of excellent quality used for bacteriological work are now being manufactured in India for the Medical Stores Department as a result of the collaboration of the Department with a Professor in a South Indian University and the Central Research Institute, Kasauli.

These include congo red, chrysoidin, methyl violet, brilliant green, eosin and Leishman's stain.

These stains had hitherto been imported mainly from Germany as specialties of a few well-known manufacturers. With the advent of the war, the Director-General, Indian Medical Service, investigated the possibility of their production in India from commercial dyes of British origin.

### INDIGENOUS SUBSTITUTE FOR PARAFFIN MOLLE

AN order for 300 tons of anti-mosquito cream, perhaps the largest order for an item of this kind ever placed, is being complied with by the Medical Stores Department. Paraffin molle, an ingredient of this cream, which was imported and was in the past difficult to obtain, has now been successfully replaced by hardened vegetable oil of indigenous manufacture.

## Public Health Section

## NUTRITION

DURING recent years there has been a great advance in our knowledge of the science of nutrition. This advance has been rapid, far reaching, and spectacular, arousing the interest not only of medical men and scientists but of the ordinary citizen, of governments, and of public bodies. The development of this newer knowledge of nutrition, as McCollum has termed it, has upset long-established beliefs and raised questions of great practical importance on the adequacy of diets in common use, on existing food habits, on dietary requirements, on the extent of malnutrition, and on the direct and indirect effect of nutrition, on efficiency, on health, and on disease. The most outstanding feature of this advance has been the upsetting of the orthodox view on the dietary requirements of man. Beri-beri, scurvy, rickets and pellagra, which have been responsible for such ravages in man, have been found to be due to the deficiency of certain essential formerly undefined food factors, the vitamins. The last two decades have seen the mysterious and elusive vitamins becoming definite chemical entities with well-defined chemical and physiological properties.

It is the understanding of these new nutritional factors which has revolutionized our ideas on food requirements and the effect of food on health. More important than the clinical recognition of deficiency diseases has been the fact that much ill-defined ill health and many conditions of obscure ætiology are due to minor degrees of deficiency. The response of these conditions to the administration of nutritional factors has been so striking that therapeutic dietetics has become an important branch of medicine. In the wider field of public health this new knowledge is proving of the greatest value. Dietary and nutrition surveys are repeatedly showing the high general incidence of malnutrition in most sections of the population. Public health measures are being introduced to provide milk, cod-liver oil, and other protective foods for mothers, infants and school children. The provision of adequate nutrition to all people has become perhaps the most important social question of our time.

The development of this nutritional knowledge has been so rapid that the average medical practitioner and the public health worker have not been able to keep pace with this advance. Yet, the importance of this subject is such that neither the physician nor the health officer can afford to ignore the application of this knowledge to their respective fields, without serious loss of efficiency. In this new section on public health, facts pertaining to nutrition will be presented from time to time.

## STUDIES ON THE VITAMIN-A CONTENT OF GHEE

By M. C. MUTHANNA\*, M.Sc.

and

P. K. SESHAN, M.Sc.

*(Department of Biochemistry and Nutrition, All-India Institute of Hygiene and Public Health, Calcutta)*

GHEE and butter, in spite of their importance as articles of diet in India, have not received sufficient attention as regards their nutritive essentials, especially vitamins A and D. Wright (1937) after a survey of the ghee industry in India estimated that about seventy crores of rupees worth of ghee are being manufactured in India annually.

Ghee, or clarified butter, is prepared as a cottage industry in the Indo-Gangetic plains, Gujrat and Rajputana. The method of manufacturing ghee differs from province to province and its aroma and keeping quality depend on the mode of manufacture. Ghee sold in the Indian market is grossly adulterated. The ghee merchants manage to circumvent the Food Adulteration Act by adding colouring matter, butyric esters, etc., to the adulterated ghee so as to give the characteristic physical and chemical constants of pure ghee. Purity of ghee is tested mainly by its physical and chemical properties, such as the butyro-refractometer reading, Reichert-Wollny value, acid and iodine value, fluorescence, etc. There being no standards for vitamin-A and D content of ghee, usually these are not tested. But ghee is the most important source of these vitamins particularly for the vegetarian. The ghee is usually stored in tins in open and warm places. All this causes the consumer to lose much of the nutritive value of the ghee.

It was felt that a survey of the vitamin-A content of ghee from different provinces would be interesting. The stock of animals in various provinces differs and so also their fodder, according to the climatic environment. All this will cause considerable variation in the vitamin-A content of butter and ghee. The survey incidentally would also give a rough index of the state of nutrition of the cattle and the richness of the fodder. The vitamin-A content of ghee sold in Bengal and Sind has been determined. The effects of heat, exposure and storage on the vitamin-A content of ghee have also been studied. Since some merchants sell ghee of high Reichert-Wollny (R-W) value at an enhanced price, one of the objects of the present study was to determine whether ghee of high R-W value has higher vitamin-A content than those of low R-W value. The present paper gives a

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report on some of the results obtained during the study.

Banerjee (1936) and Banerjee and Sunawala (1936) studied the vitamin-A content of ghee and butter of both cow and buffalo by the anti-mony trichloride method giving the Carr-Price blue units. Grewal and Kochhar (1938) studied the vitamin-A content of Punjab town and village ghee by the same method. Banerjee and Doctor (1938) also studied the loss due to exposure, irradiation and auto-oxidation of vitamin A in ghee using the same method. It is now established that the Carr-Price method of determining vitamin-A content does not give comparable values and cannot be expressed in absolute quantities of vitamin A. The correct method of estimating the vitamin-A content is by the spectro-photometric method of determining the quantity of absorption of radiations 3280 Å by the substance. This gives very reliable values. Using this method De and Majumdar (1938) have determined the vitamin-A content of ghee and butter generally obtained in Madras. They have also studied the loss of vitamin A due to cooking, exposure, etc. The vitamin-A content of Madras ghee was about 25 international units per gramme, or 8.3γ.

A large number of samples of ghee kindly supplied by the Director of Public Services, Karachi, and the Director of the Bengal Public Health Laboratory, Calcutta, were analysed and the R-W values and the butyro-refractometer (BR) values determined. Samples of ghee which had R-W values higher than 24 were selected for the determination of the vitamin-A content. The outfit used for this purpose was Zeiss-spectrophotometer fitted with spectrophotometer. Ten grammes of ghee were saponified and the non-saponifiable fraction of the ghee was dissolved in 25 c.cm. of cyclohexane and the extinction coefficient was measured by the quartz spectrograph. From this the extinction coefficient of a 1 per cent solution in a 1 c.cm. column of liquid at 3280 Å was calculated.

This value multiplied by 53.33 expresses the vitamin-A content in microgrammes (1/1000 of a milligramme) per gramme. One milligramme contains about 3,000 international units of vitamin activity.

**Result.**—The vitamin-A contents of ghee sold in Sind and Bengal are given in tables I and II.

To study the loss of vitamin A, samples of butter were heated to different temperatures and kept for 5 minutes and then the vitamin-A content was assayed. The loss is expressed as percentage in the table. The result of two typical cases are given in table III.

In order to study the loss of vitamin A due to air and sunlight, the following procedure was adopted. Ten grammes of ghee were weighed in petri dishes 4 inches in diameter, so that the surface area was the same. Then these were exposed to direct sunlight and air for known durations. Then the vitamin-A contents were

TABLE I

*Sind ghee*

Number	R-W value	BR value at 40°C.	Vitamin A in γ per gramme
1	24.2	43.1	13.0
2	26.0	41.8	14.5
3	27.1	42.4	17.5
4	27.3	42.6	6.5
5	28.0	42.1	12.0
6	28.5	42.3	8.0
7	29.4	42.0	12.0
8	30.6	41.6	5.0
9	32.7	41.8	9.0
10	33.7	41.8	8.0

TABLE II

*Bengal ghee*

Number	R-W value	BR value at 40°C.	Vitamin A in γ per gramme
1	24.0	42.6	8.0
2	25.0	44.0	7.0
3	25.2	42.7	7.0
4	26.0	43.7	9.0
5	27.6	42.7	12.0
6	28.5	43.0	5.0
7	29.0	43.0	7.0
8	30.9	42.5	12.0
9	35.9	40.3	10.5

TABLE III

*Loss due to heating*

Number	Temperature, °C.	R-W value	BR value at 40°C.	Vitamin A γ per gramme	Percentage of loss
1	50	31.1	41.8	14.5	Nil
	75	31.1	41.8	14.5	Nil
	100	31.1	41.8	14.5	Nil
	135	31.1	41.8	9.0	38.0
	160	31.1	41.8	0.0	100.0
2	50	32.4	41.7	9.0	..
	75	32.4	41.7	9.0	Nil
	100	32.4	41.7	8.5	6.0
	125	32.4	41.7	7.0	29.0
	150	32.4	41.7	0.0	100.0

assayed in the usual manner. Table IV gives the observations of a typical sample.

TABLE IV

*Loss due to exposure to sunlight*

Time of exposure	R-W value	BR value at 40°C.	Vitamin A γ per gramme	Percentage of loss
Unexposed	31.6	42.6	8.0	Nil
5 minutes	31.6	42.6	8.0	Nil
10 "	31.6	42.6	5.3	34.0
15 "	31.6	42.6	4.0	50.0
30 "	31.6	42.6	0.0	100.0

To study the loss of vitamin A due to ultra-violet radiation similar experiments were conducted by exposing the ghee in open dishes to the ultra-violet radiations of a Hanovia quartz mercury arc kept at a distance of 16 inches from the surface of the ghee. The observations are given in table V.

TABLE V  
Loss due to exposure to ultra-violet light

Time of exposure	R-W value	BR value at 40°C.	Vitamin A $\gamma$ per gramme	Percentage of loss
Unexposed	31.6	42.6	8.0	..
1 minute	31.6	42.6	4.5	40.0
2 minutes	31.6	42.6	4.0	50.0
3 "	31.6	42.6	3.0	60.0
10 "	31.6	42.6	0.0	100.0

Twenty samples of ghee (*viz.* those listed in tables I to III) whose vitamin-A content is known were tested for their fluorescence. On exposure to the quartz mercury arc fitted with an ultra-violet filter all of them fluoresced intense greenish blue. Using a Pulfrich photometer, the fluorescence of these samples was compared, keeping the ghee which contained 17.5 $\gamma$  per gramme of vitamin A as standard. It was observed that the intensity of fluorescence had no relation to the vitamin-A content as all of them showed nearly the same fluorescence.

From the results presented above the following conclusions are drawn :—

(1) The vitamin-A content and Reichert-Wollny values of 10 samples of ghee from Bengal and Sind provinces have been studied. Sind ghee contains on an average 12 $\gamma$  of vitamin A per gramme, while Bengal ghee contains about 8 $\gamma$  of vitamin A per gramme.

(2) There is no relationship between R-W value and the vitamin-A content of ghee.

(3) The study on the loss of vitamin A by heating shows that the loss begins to appear at temperatures higher than 100°C.

(4) Considerable and rapid loss of vitamin A is observed when ghee is exposed to sunlight.

(5) There is no correlation between vitamin-A content and fluorescence of ghee.

Because of the wide prevalence of vitamin-A deficiency diseases in India and the large availability of ghee, the question whether ghee can supply the daily human requirements of vitamin A is important from a nutritional point of view. Unlike the other vitamins, vitamin A is stored in the liver and the daily requirement of an adult has been assessed to be about 1,000 $\gamma$  of vitamin A. It has been observed in the above study that good butter after clarification gives a ghee which contains about 10 to 15 $\gamma$  of vitamin A per gramme. The daily needs of vitamin A will be satisfied only if there is a daily intake of 100 to 150 grammes of ghee (3

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# MICROBIOLOGY

## INCIDENCE OF SALMONELLA INFECTION IN RATS IN CALCUTTA

By S. C. GHOSAL, M.B., D.P.H., D.B. (Lond.)

(From the Department of Microbiology, All-India Institute of Hygiene and Public Health, Calcutta)

*Review of literature.*—In England and America rats have been incriminated as important reservoirs of salmonella organisms. Savage and Read (1913) examined the liver, spleen, faeces and heart-blood of 41 rats and isolated five strains of *Salmonella enteritidis*. Savage and White (1923) isolated six strains of the same organism from the liver, heart-blood and intestinal content of 96 rats. Kerrin (1928) made cultures of spleen and liver of 100 rats and isolated 11 strains of *S. enteritidis*. Recently Khalil (1938) in a more extended series isolated 45 strains of *S. enteritidis*, 40 strains of *S. typhi murium*, three strains of *S. newport* and one strain of *S. thompson*, respectively, from 750 rats. In America, Meyer and Matsumura (1927) examined 775 rats and isolated 28 strains of *S. enteritidis* and 30 strains of *S. typhi murium*. Verder (1927) also recorded the isolation of five strains of *S. enteritidis* and one of *S. typhi murium* from 114 rats. Furthermore, Salthe and Krumwiede (1924), Savage and White (1925), Jones and Wright (1936) have definitely incriminated rodents (rats and mice) as the source of infection in certain outbreaks of food poisoning. As far as we are aware, no work on the above lines has been done in India. Outbreaks

(Continued from previous column)

to 5 ounces). This however is impracticable. Yet as at present the quantity consumed is but a small fraction of the needs, systematic propaganda for larger consumption of ghee by all classes of people will be valuable, especially as ghee is available in large quantities, and is the only animal fat consumed by the average vegetarian Indian.

## Acknowledgments

The authors desire to express their indebtedness to Bt.-Col. Sir R. N. Chopra and to Prof. G. Sankaran for their kind interest in this work. They also desire to thank Mr. K. K. P. N. Rao for help in this work.

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of food poisoning due to salmonella organisms are not of infrequent occurrence in Calcutta. A close association also exists between human beings and rats in the city. It was felt worth while therefore to conduct a survey on the incidence of salmonella infection in rats in Calcutta.

*Source and species of rats.*—The majority of rats for this investigation were collected from the port area. Many were also obtained from residential houses, slaughter houses, markets, and bustees. Fifty per cent of the rats examined were *G. varius*, 30 per cent *R. rattus* and the remaining 20 per cent *R. norvegicus*.

*Technique of investigation.*—Bits of liver, spleen and intestine (colon) were put into tetrathionate broth (Jones, 1936) incubated at 37°C. for 18 hours and then plated on MacConkey's plates. In the beginning, both Mueller's broth and Kauffmann's (1935) modification of it were used for enrichment, but the latter was given up later as there was no special advantage in its use. Suspicious colonies were picked up from the plate and slide agglutination with standard O sera (Oxford standard agglutinating sera and sera supplied by Dr. Kauffmann) was done for preliminary identification. Strains giving positive agglutination were subcultured and examined morphologically, and biochemically in the usual manner. Final diagnosis was made by macroscopic agglutination with H and O sera, separately. On fresh isolation many strains gave cross agglutination with both *typhi murium* and *enteritidis* O sera; this was due probably to the presence of common antigen XII, but after a few subcultures this feature was not noticed.

*Results.*—In all, 364 rats were examined and the results are given below :—

TABLE I  
Showing the number of positive rats and the strain isolated

Organisms	Number of rats positive	Number of strains isolated	Percentage of positive rats
<i>S. enteritidis</i> ..	13	22	3.57
<i>S. typhi murium</i> ..	36	59	9.89
TOTAL ..	49	81	13.46

TABLE II  
Showing the distribution of infection in different organs

Organisms	L only	S only	I only	L and S	L and I	S and I	L S and I
<i>S. enteritidis</i> ..	4	2	1	3	2	1	1
<i>S. typhi murium</i> ..	7	5	3	10	4	2	4

L = Liver.

S = Spleen.

I = Intestine.

TABLE III  
Showing the number of strains isolated from each organ

	<i>S. enteritidis</i>	<i>S. typhi murium</i>
Liver ..	10	25
Spleen ..	7	21
Intestine ..	5	13
	27.2%	72.8%

TABLE IV  
Infection rate in the different species of rats

Species of rats	Percentage of infection
<i>G. varius</i> ..	12.2
<i>R. rattus</i> ..	14.1
<i>R. norvegicus</i> ..	13.9

*Discussion.*—It will be seen from table I that 13.46 per cent of the rats examined were found infected with salmonella organisms (*vide* also table IV). This figure is much higher than the results of any previous worker who has dealt with a large number of rats. For example, Meyer and Matsumura isolated salmonella organisms from 7.5 per cent of the rats examined, while Khalil found only 7.3 per cent positive. As regards the species of salmonella isolated, it will be noticed that there was a great preponderance of *S. typhi murium*. While the infection rate for *S. enteritidis* was only 3.57 per cent the rate for *S. typhi murium* was 9.89 per cent. Also of the 81 strains isolated 27.2 per cent were *S. enteritidis* and 72.8 per cent *S. typhi murium*. Most investigators outside India have found *S. enteritidis* as the predominating organism and a few *S. enteritidis* and *S. typhi murium* equally common. In Calcutta infection with *S. typhi murium* appears to be more frequent.

From tables II and III it will be seen that 18 out of 49 positive rats were found to be harbouring the organisms in the intestine. This works out to an intestinal infection rate of 5 per cent in the total rats examined. This is a very high figure and it is unnecessary to emphasize the danger of contamination of food with the infected faeces of these rodents in the city, especially as the hygienic sense of the population is not too well developed and as the rodents live in intimate association with human beings. It is suggested that in future all outbreaks of food poisoning be investigated with a view to finding out (a) the causal agent, and (b) its source. It may also be necessary to start an anti-rat campaign in the city.

#### Summary

(1) Three hundred and sixty-four rats were examined for salmonella infection and 49 or 13.4 per cent were found positive.

(Continued at foot of opposite page)

## VALUE OF EIJKMAN TEST IN THE DIFFERENTIATION OF AEROGENES ISOLATED FROM MILK

By R. BANERJEA, M.B., D.T.M., D.P.H.

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THE Eijkman test (1904) was originally introduced for the differentiation of 'faecal coli' from 'aerogenes'. The experience gained in the last few years has however shown that the test is not as valuable as it was at first supposed to be. Wilson (1935) has introduced important modifications in the technique and has claimed that the modified test is of very considerable value in differentiation. In India however even Wilson's modification has not proved very helpful in all cases. Raghavachari and Iyer (1939), working with several strains of aerogenes isolated from water, found that about 60 to 70 per cent of the strains were Eijkman-positive instead of negative. The writer, in the course of his work on the bacteriological analysis of milk samples in Calcutta had used the Eijkman test for differentiation of faecal coli from aerogenes, found that positive Eijkman tubes also showed presence of aerogenes in fair numbers. Although this observation preceded the observations of Raghavachari and Iyer quoted above it was not published.

The present work was therefore undertaken to corroborate the above finding and to find out

(Continued from previous page)

(2) Of the positives 72.8 per cent were infected with *S. typhi murium* and 27.2 per cent with *S. enteritidis*.

(3) In 5 per cent of the rats the organisms were being excreted through the intestine.

### Acknowledgment

I wish to thank Dr. K. V. Krishnan, M.B., B.S., M.R.C.P., D.B., D.Sc., Professor of Microbiology, All-India Institute of Hygiene and Public Health, for the help and advice received in the course of the work.

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the true value of Eijkman test in the differentiation of aerogenes isolated from milk. From 50 samples of milk obtained from various sources a total of 153 aerogenes strains was isolated and tested by Eijkman's method as modified by Wilson. MacConkey broth tubes were inoculated with a loopful of a young peptone water culture of the organism and incubation was done in an electrically-heated covered water-bath made of copper, set exactly at 44°C.; and the temperature recorded was of the MacConkey broth medium and not the water in the bath. The results obtained are given below :—

TABLE

Number of aerogenes examined	Number of aerogenes giving positive Eijkman test at 44°C.	Percentage positive	Number of aerogenes giving negative Eijkman test at 44°C.	Percentage negative
153	106	66.28	47	30.72

It will be seen from the table that about 70 per cent of aerogenes obtained from milk isolated in Calcutta gave a positive Eijkman test. As the strains of aerogenes used were all citrate-positive, the above result also shows that in 70 per cent of cases there was no negative correlation between Eijkman test and citrate test. This is contrary to the results of Clegg, Sherwood and Dodgson (1939) who obtained in England almost a perfect negative correlation between 44°C. Eijkman test and citrate test. A possible explanation for this discrepancy may be in the differences in the climatic conditions of the two countries—England and India. If it is recognized that the environment can influence the behaviour of bacteria then we can understand why the tropical aerogenes behave differently from the aerogenes of temperate climates. Because of higher atmospheric and soil temperatures in India, the aerogenes may have developed the capacity to live and multiply at higher temperatures. If it is so, then the differentiation by the Eijkman test is not valuable under Indian conditions.

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# BACTERIOPHAGE AS AN INDEX OF WATER CONTAMINATION

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BECAUSE of technical difficulties of isolating pathogenic bacteria from waters (even from waters known to be contaminated fairly recently), the presence or absence of *Bacterium coli* in water supplies and the relative numbers of this organism if present are recognized as indications of the presence and degree of faecal pollution. This is based on the assumption that the more bacteria of intestinal origin there are in water, the more likely are pathogenic species to be amongst them.

The presence of *Bact. coli* type I is accepted as the most delicate index of recent faecal contamination and the practical value of the 'coli test' in establishing the standards for drinking water is accepted by all those concerned with the bacteriological examination of water supplies. It must, however, be remembered that the evidence at best is circumstantial and conclusions drawn from it cannot be considered as unequivocal as conclusions based on direct evidence. Further the usual method of bacteriological examination of water gives no indication whatever of the source of any contaminating bacilli found in it. They may be from animals other than man. In addition there are many problems, connected with the multiplication of coliform bacilli which may cause difficulties in the bacteriological examination of water supplies perhaps of great significance under tropical conditions.

In order to collect more direct evidence of the presence in water of contamination with excreta of human origin, a search was made for

comparatively easy, employing appropriate methods, to isolate bacteriophages active against these organisms. The methods employed are outlined below :—

(A) The collection of water samples.—Samples of water collected in clean and sterilized bottles are satisfactory. The usual great care must be exercised to secure the samples representative of the water to be tested and to see that no contamination occurs at the time of filling the bottles. Many of the samples of water were collected in sterilized vacuumized 25-c.cm. ampoules which had been scratched with a file at the tip of their long necks. The tip was broken under the surface of water either with a pair of forceps or by a gentle tap against a stone or other object. The vacuumized ampoule fills and the tip is either sealed on the spot with a spirit lamp or closed with wax, to be sealed later. In this way extraneous contaminations are avoided. This method of collection is particularly useful when samples are to be transported any distance or when they are sent through the post.

(B) The demonstration of bacteriophages in water.—Bacteriophages active against *Vibrio cholera*, *Bacterium typhosum*, *Bact. shigae* and *Bact. flexneri* were tested for in each sample. These organisms were chosen as representing the main group of organisms responsible for intestinal infections in man and because these organisms give rise to disease in man alone.

The sample of water in the ampoule is transferred to a flask containing 50 c.cm. of nutrient broth or peptone water to which are added 1 c.cm. each of young cultures of smooth strains of *V. cholera*, *Bact. typhosum*, *Bact. shigae* and *Bact. flexneri*. The cultures used must be free from any contaminating bacteriophage. The flasks are incubated for 48 hours, N/10 NaOH added, if necessary, to maintain an alkaline reaction as shown by the indicator (phenol red) previously added to the broth. The contents of the flask are filtered through Pasteur-Chamberland L<sub>3</sub> candles and the filtrates tested

TABLE

The percentage of samples of water showing the presence of specified bacteriophages. The percentages are given to the nearest whole number

Source	Number of samples examined	PERCENTAGE OF SAMPLES SHOWING				No phages
		Typhoid phages	Dysentery phages	Cholera phages	Typhoid, dysentery and cholera phages	
River and open tank water, Calcutta	385	12	25	15	36	64
River water, Hardwar ..	62	24	31	3	43	57
Stored water in a hill station ..	23	13	22	17	43	57
Stored spring water, rural areas ..	46	2	15	Nil	15	85

bacteriophages active against organisms which cause disease in man. Whereas it is difficult to isolate pathogenic bacteria from waters it is

for the presence of bacteriophage by the drop method, using young test cultures on nutrient agar plates.

Five hundred and sixteen samples of water collected from four main sources were examined for the presence of bacteriophages active against the causative organisms of typhoid, dysentery and cholera. The results of these examinations are summarized in tabular form.

It must be stressed that the results from different places are in no way comparable nor of equal significance. The samples from Calcutta were collected from river and certain tanks throughout the year, whereas samples from other sources were collected during short periods. The samples from Hardwar were collected during and for a short period after a Kumbh Mela when the place was literally packed with pilgrims from all parts of India. Samples from the hill station were collected during the summer when there were many visitors from the plains. The number of samples examined are far too few for the results to have any real significance. It is interesting to note that stored spring waters gave the best results.

Unfortunately, it was not possible to carry out parallel bacteriological examinations of these samples. These results show that bacteriophages active against the causative organisms of typhoid fever, dysentery and cholera are present in approximately 50 per cent of the samples examined.

#### Summary

A method of examination of waters for evidence of contamination with human excreta is suggested. This is based on the assumption that the presence of bacteriophages active against human intestinal pathogens indicates that the particular sample of water has been contaminated by excreta of individuals who harbour such bacteria. The more definite information obtained by the bacteriophagic examinations of water it is suggested should lead to the inclusion of this method in the routine examination of water.

## THE TUBERCULOSIS ASSOCIATION OF INDIA

### *The Lady Linlithgow Tuberculosis Sanatorium, Kasauli*

HER Excellency the Marchioness of Linlithgow, the President of the Tuberculosis Association of India, performed the opening ceremony of this all-India institution on the 21st May, 1941, in the presence of a distinguished gathering. This sanatorium will have accommodation for 112 beds to begin with, which, it is hoped, in course of time will be increased to 250 beds.

The sanatorium is to some extent a co-operative institution as regards its maintenance, the system providing a lien on one or more beds in return for an annual contribution. Apart from

an annual grant of Rs. 20,000 by the Government of India, support for the maintenance is received from the Punjab and United Provinces Governments, the States of Chamba, Gwalior, Jind, Jodhpur, Lunawada, Patiala and Travancore, from the Pasteur Institute Association of India, and also from the Tuberculosis Association of India, Bengal, Delhi and Sind.

An alternative contributory system is by endowment of beds at a cost of Rs. 20,000 each. This system has been adopted by Lala Shankar Lal of Delhi, two beds, and by Nabha and Tehri (Garhwal) States, one bed each.

In addition to these contributions, Sir Shri Ram has made a generous unconditional donation of Rs. 5,000 a year for ten years.

At the opening ceremony two munificent donations were announced to the funds of the sanatorium, one from Her Excellency Lady Linlithgow, the President of the Tuberculosis Association, of Rs. 20,000, and one from the Patron, His Excellency the Viceroy, of Rs. 10,000.

Dr. T. J. Joseph, formerly medical superintendent of the Pendra Road Sanatorium, has been appointed medical superintendent of the Lady Linlithgow Tuberculosis Sanatorium, and Dr. H. N. Sahgal has been temporarily lent by the New Delhi Tuberculosis Clinic for the post of second doctor for the sanatorium.

In Her Excellency's opening speech she remarked:—

'I want now to give you a true picture of the scheme. It would be a complete misunderstanding of the objects of the scheme if it was thought that this sanatorium was established only for the treatment of 100 patients. It, therefore, will not be out of place to explain that, apart from the benefit which will accrue to the individual patients, the scope of the institution is a far wider one. This sanatorium is to be a teaching institution where practical demonstration of the various up-to-date methods of diagnosis and treatment will be available to doctors from all parts of India. This is very necessary in a country where in the majority of sanatoria and tuberculosis clinics the level of efficiency is far below what it should be.

It is necessary to emphasize that the greatest difficulty in the tuberculosis campaign in India is not, as generally supposed, lack of money, but the lack of a sufficient number of doctors properly trained in modern methods of diagnosis and treatment. It is a hopeless task to try and fight tuberculosis in India without having doctors who have specialized not only in diagnosis and treatment but also in the prevention of the disease and in the care and after-care of the tuberculous patient. The difficulty facing us is not the lack of doctors willing to take up special training, but that there are in India too few places where all the facilities exist for the proper training of such doctors. This training requires at least nine months' residence in a fully-equipped modern sanatorium, such as this

one, where doctors can gain experience in the wards, in the operating theatre, the x-ray and the laboratory. Research work will also be carried out there, without which no teaching institution can be complete. By research I don't mean only bacteriological research, but research necessary with regard to the development of the disease and the various treatments.

While bacteriological research can be carried out in a comparatively small institution, the other kind of research can only be effectively carried out in a sanatorium or hospital with a large number of patients.

The object of the Kasauli scheme is a very wide one and it is intended that the institution should serve the whole of India by effective co-operation with those sanatoria and clinics which have not got the facilities necessary. From institutions where patients are not able to have the modern chest operations, it is proposed that they should be sent to Kasauli where these operations could be performed and where possibly they need not be detained for more than two months after which they would return to the institution which sent them, for further treatment. This co-operation is of the utmost importance to get the full value out of the Kasauli scheme as in this way hundreds of patients each year could take advantage of the facilities to be obtained here.

#### *New tuberculosis institutions*

**Bengal.**—The Government of Bengal have approved the proposal to establish a tuberculosis sanatorium at Peshok in the Darjeeling district. Steps for acquisition of land are already under way and provision has been made in the budget for 1941-42.

**Assam.**—There is only one chest clinic in the province situated in Shillong, attached to the Civil Hospital. Some special equipment was supplied by the Tuberculosis Association and some was presented by Major R. A. Haythornthwaite. Two home visitors are attached to it. An x-ray department has also been opened.

Jhalupara on the border of Shillong town has been selected for the location of a tuberculosis sanatorium for the province.

A comprehensive programme has been drawn up by the Assam Provincial Tuberculosis Association and the Assam Government, it is learnt, has provided a sum of Rs. 90,000 in their budget for capital expenditure in connection with the scheme.

**The United Provinces.**—The first of the chain of tuberculosis clinics in the United Provinces has been opened in the King Edward VII Hospital. The Provincial Tuberculosis Association has granted Rs. 8,000 to the clinic and the Benares Municipal Board has sanctioned an annual grant of Rs. 1,200.

**N. W. P.**—(1) The Government Tuberculosis Sanatorium, Dadar, Hazara district, was built at a cost of Rs. 1,84,000 and was

equipped at a cost of Rs. 20,000. The maintenance expenses come to Rs. 36,228 per annum. Two medical officers trained in tuberculosis are attached to it.

(2) In Haripur there is a four bed tuberculosis ward attached to the Civil Hospital. This ward cost Rs. 3,212 and was equipped at a cost of Rs. 1,538. A part-time medical officer is attached to it.

(3) The Tuberculosis Ward, District Jail, Abbottabad, was built at a cost of Rs. 19,917. One full-time sub-assistant surgeon is engaged and the annual maintenance expenditure comes to Rs. 4,000 per annum.

(4) The Tuberculosis Clinic in the grounds of the Lady Reading Hospital, Peshawar, was built at a cost of Rs. 10,000. One full-time medical officer trained in tuberculosis and three health visitors are attached to it. The annual maintenance expenditure comes to Rs. 8,000.

**Baluchistan.**—A tuberculosis clinic has been opened in Quetta, as a vital necessity to the Baluchistan Tuberculosis Sanatorium.

**Cochin State.**—As a result of the campaign against tuberculosis initiated by Her Excellency Lady Linlithgow, a new tuberculosis clinic has been opened in the middle of February 1941, at Trichur in the compound of the Civil Hospital. The total expenditure on the clinic has been Rs. 30,000 inclusive of Rs. 17,000 spent on its equipment. Mr. Thattil Kochuvaried, a merchant of Trichur, gave a donation of Rs. 10,000 for the construction of the clinic, the balance being met from the subscription of the State to the King Emperor's Anti-Tuberculosis Fund. The clinic has an accommodation for 14 patients.

The clinic has been placed in charge of a doctor whose services have been lent to the Cochin State by the authorities of the Arogyavaram Sanatorium.

The clinic has become very popular within the first few days of its opening. Already over 200 patients were attending every day by the beginning of March.

#### **PUBLIC HEALTH REPORTS**

**ANNUAL PUBLIC HEALTH REPORT OF THE PROVINCE OF ASSAM FOR THE YEAR 1939.**  
BY LIEUT.-COLONEL A. M. V. HESTERLOW, M.B., Ch.B. (EDIN.), B.Sc., P.H. (EDIN.), D.T.M. & H. (EDIN.), I.M.S., DIRECTOR OF PUBLIC HEALTH, ASSAM.

THE climatic, agricultural and economic conditions during the year were on the whole satisfactory. Rain-fall was in deficit till the month of May but from that time onwards—except in the month of August when it was again in deficit—it left no room for complaint. Agricultural operations proceeded apace and, in the absence of any setbacks in the form of floods or prolonged droughts, resulted in a fair harvest. Prices of agricultural produce showed a slight rise owing, apparently, to the tense international situation which prevailed in the earlier part of the year and which later culminated in the outbreak of war in September. The sum total of all these factors is reflected in the general well-being of the people.

The agency for collecting the vital statistics remained the same as before and the figures representing vital occurrences in the different areas may be presumed to

be as reliable as those of the previous years. In the working out of ratios, on the other hand, a change has been made this year; the ratios have been worked out not on the basis of the census population of 1931 as hitherto but on what is termed the 'estimated population'. As the estimated population has apparently taken no account of the increase of population by immigration, the ratios pertaining to areas such as Kamrup, Nowgong, Darrang and Lakhimpur where immigration is active should be accepted with caution.

The statistics show that, like the North-West Frontier Province and Sind, Assam had a lower birth rate and death rate than the remaining provinces in India. The birth rate (28.44) compares well with the quinquennial average (28.40) and the death rate (19.25) with the quinquennial average (19.63). Infantile mortality was lower than in any other year during the last ten years but even so the rate, viz, 149.73 per mille, is high. The table showing mortality according to sex and age shows that wastage of life is higher among the males till the age of 15 is reached after which till the age of 40; at any rate, the wastage is markedly larger among the females. It is perhaps safe to assume that this larger wastage of life among the female population is in some way connected with the strain of child bearing. This appalling loss of young mothers and children brings into prominence the need of expansion of maternity and child-welfare work.

The saving of young life is, however, only a part of the bigger problem of protecting human life in general by preventive means. Of the diseases accounting for deaths during the year, the chief ones are fevers, dysentery, diarrhoea, cholera and small-pox.

The head 'Fever' includes not only malaria and kala-azar but also various diseases having fever as their predominant symptom. It may not be possible to state the proportions of deaths occasioned by the various diseases falling under this head. But it is common knowledge that malaria accounts for by far the largest number. The amount of sickness due to malaria is even larger and the importance of carrying on an incessant fight against this scourge which literally saps the vitality of the population has constantly been before the mind of the Government. Apart from the anti-larval operations carried on in various places under the supervision and guidance of the Assam Medical Research Society, quininization is being extended to the limit of the provincial resources, in spite of the stoppage of free supply of quinine hitherto made by the Government of India and the increase in price of the anti-malarial drugs due to the war.

There is probably room for more consumption of the anti-malarial drugs and as it would be impracticable to purchase all the amount needed, Government are directing their attention towards the cultivation of cinchona within the province.

Kala-azar continued to show signs of recrudescence. An increase in the staff and intensification of surveys led to a greater number of cases being detected and treated than in the previous year. Goalpara, Nowgong and Sibsagar between them accounted for the greater part of the increase. New treatment centres were opened wherever necessary and in Golaghat (Sibsagar district) arrangements were made for in-door treatment of cases which were either too ill to travel or showed complications requiring closer medical observation.

Typhoid fever is a difficult disease to diagnose and statistics even from town areas cannot be said to be reliable. It is suspected that contaminated water-supply is a contributory cause and Government would like to draw the attention of those municipal bodies which have not yet provided uncontaminated sources of water-supply to their responsibility in the matter.

Cerebro-spinal fever which claimed 235 victims in the Naga Hills and Manipur State during the preceding year claimed only 11 during the year under report.

*Cholera, dysentery and diarrhoea.*—As against 11,907 deaths from cholera in the preceding year the number of deaths in 1939 was 3,020, out of which 1,470 occurred in January and represented the end of the previous year's epidemic. The death rate was less than half of

the decennial average and the year in question must be regarded as having been remarkably free from cholera. The department was on the whole prompt in sending medical aid but there is still room for improvement in the prompt reporting of first cases from out-of-the-way places. The question of effecting an improvement in this matter and in diffusing general knowledge as regards first steps which the villagers can take before medical aid reaches them is engaging the attention of Government.

*Small-pox.*—This was the only disease, the number of deaths from which was greater in 1939 than in the preceding year. Considering that vaccination is a sure protection and that, if the statistics of vaccination appended to the report year after year are to be believed, the entire population should have been vaccinated long ago, it would be well for the director to find out whether and how far the failure is due to (1) the insufficiency of the staff and vaccine, (2) failure or reluctance of the staff to visit out-of-the-way places and (3) reluctance of persons to undergo vaccination.

*Maternity and child-welfare work.*—Mention has already been made about the importance of maternity and child-welfare work. Progress has been difficult for various reasons; for one thing, neither the Government nor the local bodies nor the Red Cross Society have sufficient funds; for another, trained staff is limited. Nevertheless, further progress is being planned. With the growing appreciation of the work of trained *dais* the demand for training of *dais* is increasing. Facilities for informal training of a sort exist in various hospitals as well as at the Berry-White Medical School. The question of prescribing a formal course of training together with a suitable curriculum is under consideration. A Bill for registration of *dais* along with nurses and others is also under preparation.

*Leprosy.*—Government acknowledges with thanks the part played by the missions and the British Empire Leprosy Relief Association in the relief of leprosy. Among the leprosy colonies run by missions and deserving of special mention are those in the districts of Sibsagar and Goalpara, while the British Empire Leprosy Relief Association has assisted by providing funds for the construction of several centres for out-door treatment and the training and entertainment of a special leprosy officer for the purpose of co-ordinating effort. It is hoped that the visit of Dr. Santra, Propaganda Officer of the Association in the cold weather, will lead to the formation of a comprehensive policy and plan. Local enthusiasm would need to be kindled if steady progress is to be achieved.

*Food adulteration.*—This is unfortunately a growing evil. The administration of the Assam Pure Food Act has been far from satisfactory. Except in municipal areas with health officers, there is hardly any attempt to enforce the Act. One of the difficulties probably is to enlist the co-operation of a sufficient number of local persons with the requisite spirit of public service and leisure. The procedure for sending samples for analysis strikes the average person as being unduly elaborate but it cannot be over-simplified if the accused is to have a fair trial and his guilt definitely established. Government propose to investigate the suggestion that a substantial reduction in the rate of fees charged for analysis will help to mend matters.

*Propaganda.*—Public-health exhibitions which have an enormous propaganda value seem to have already fallen into disuse. Apart from the treatment of epidemics as they arise the main function of the department lies in a wide diffusion of the science of healthy living. This diffusion has to be not of abstract ideas but of concrete shape into which these ideas are translated and presented in a form suited to easy assimilation by the people. The department has to be ready with type plans of model houses, latrines, uncontaminated water-supply, etc., suited to the means and conditions of the villagers. Balanced diet, causation and prevention of diseases, and first aid are also matters on which the public needs constant advice. It is only when solutions have been found in these matters and presented to the villager in a manner calculated to



enlist his active co-operation that the department will be able to look with satisfaction on its work.

## ANNUAL REPORT OF THE MYSORE STATE DEPARTMENT OF PUBLIC HEALTH FOR 1939

Two thousand three hundred and fifty-two deaths from plague were reported as against 5,196 in the previous year. As a preventive measure, in addition to the 132,536 anti-plague inoculations, rat destruction by means of cyanogas fumigation was carried out in nearly 27,000 houses in various parts of the State, including the cities of Bangalore, Mysore and the Kolar Gold Field. There were only 533 deaths from cholera. It is gratifying that this disease is not endemic in the State and that if timely measures are taken to prevent infection from outside, it is quite possible to control it.

*Vital statistics.*—The new system of compiling vital statistics introduced in the State in 1938 was adopted as a model for the other Provinces and States of India.

*Public health institute.*—Sixteen thousand five hundred and twelve samples in the Bacteriological section, 2,543 samples in the Chemical section and 312 cases with 1,141 articles in the Medico-legal section were examined. During the year 11,010 c.c.m. of anti-cholera vaccine and 31,531 c.c.m. of T.A.B. vaccine were issued for use. Biological methods of investigation of the nutritive value of foodstuffs were continued.

*Bureau of health education.*—During the year, 173 cinema shows were given in 103 places in all the districts to an audience of about 105,000, compared with 190 shows in 94 places to an audience of 114,000 in the previous year. The permanent Health Museum in Mysore was kept open to the public throughout the year. Two models of a bore-hole latrine and a bore-well, respectively, were added to the exhibits during the year and another of a rat-proof house was under construction. Health exhibitions were also held in Bangalore City and the Kolar Gold Field on the occasion of the 75th anniversary celebrations of the Red Cross Society. Village improvement works on a health league basis were carried out in the Health Training Centre, Closepet, in 40 villages.

*Bureau of epidemiology—malaria control.*—Among the several anti-malaria measures sanctioned during the year may be mentioned the permanent anti-malaria engineering works at Hiriyur, the anti-malaria work at Belur, the malaria control work around the Princess Krishnammanni Sanatorium, Mysore City, and the starting of itinerant dispensaries at Krishnarajnagar and Pavagada.

Malaria control was continued during the year in the Bhadravati old and new towns, and at Marconahalli, T. . . . Shimshapur, Chikmagalur, Belur, J. . . . Half-yearly spleen and parasite surveys of the ten control and the four comparison villages of the Mandya Malaria Unit were made. The permanent anti-malaria engineering measures under execution at Bevinahalli, Kyatanagere and Sundahalli were in progress during the year.

The staff deputed for guinea-worm control visited 672 villages, examined 570 wells and restocked fish in 266 wells, while that engaged in hookworm control work visited 97 villages in the Periyapatna Taluk, also making a spleen survey in these villages and distributing 4,821 totaquina tablets to persons actually suffering from malaria.

*Bureau of sanitary engineering.*—The work of this bureau was divided into five sections, viz, Water-supply, Drainage, Town Planning and Surveys, Sanitary Fittings and Installation, and Bore-wells. A separate division was created during the year for the Bangalore city drainage works. The bureau maintained the water-supply installations of twenty-five places and completed ten out of the twenty-one drainage works under execution. It also prepared plans for the improvement of junctions and extensions and for slaughter houses and mutton stalls and designs for dwelling and farm houses, rat-proof dwellings and cattle pounds.

*Bore-wells.*—The total number of bore-wells drilled for local bodies up to the end of December 1939 was 156. In the year under report, twenty-one bore-wells were completed and ten were in progress.

*Bore-hole latrines.*—Three hundred and forty-nine bore-hole latrines were constructed during the year.

Among the important measures carried out during the year may be mentioned (1) the constitution of a Combined Local Health Committee for the consideration of health problems in which the civil, the military and the railway authorities are concerned and for the solution of which the co-operation of all these bodies is required; (2) the constitution of a Central Health Committee with the Member of Government in charge of the Public Health Department as Chairman and the Director of Public Health as Secretary; (3) the training of thirty-nine students in the Sanitary Inspectors' Training Class; (4) the deputation of Dr. V. Narasimha Murthy to Bombay for training in the manufacture of plague vaccine and (5) the delimitation of the areas of operation for the respective agencies of the Bangalore City and the Civil and Military Station authorities to avoid overlapping of activities in respect of malaria work.

## REPORT ON THE PUBLIC HEALTH ADMINISTRATION OF THE PUNJAB FOR THE YEAR 1939

The estimated mid-year population of the province for 1939 was 27,231,113 representing a further increase of half a million over the figure for the preceding year and an increase of nearly 16 per cent over the census figure. The birth rate was 40.8 *per mille* compared with 43.7 in the year 1938, the decline being more marked in the districts of the Ambala division where famine conditions prevailed. Famine conditions also accounted for more deaths in the south-eastern districts, except in Gurgaon; but the total number of deaths in the province was less than in the preceding year and the death rate was lower by 1.2 *per mille*. More than half the deaths occurred amongst children of not more than five years. The infantile mortality rate was 167.57 which is still very high, although lower than the average of the last ten years and indicates that a great deal yet remains to be done in the domain of child welfare work.

As in the preceding year two-thirds of the total number of deaths were recorded as due to fever of some kind, such as malaria, enteric, measles, etc. But little significance can be attached to these figures, as the primary reporting agencies are prone to describe the cause of death as fever without taking the trouble of obtaining accurate information. That the figures cannot be regarded as reliable or of any real value is clear from the fact that in the Amritsar district where 2,760 deaths were reported under the group 'Fever', 82 per cent of them were found on investigation by the medical registrars to have been due to some other cause. It is, however, known that malaria was not unduly prevalent during the year under report. More than 4,000 lb. of quinine and cinchona febrifuge were distributed free. Other anti-malaria measures were also carried out, so far as was possible with the limited personnel and funds at the disposal of the Public Health Department.

Of 4,311 deaths which were due to small-pox more than 50 per cent occurred amongst children under five years of age. Over 4½ million vaccinations were performed during the season 1939-40; but a vigorous vaccination campaign on a widespread scale can achieve full results only when all births are registered and the outbreak of the disease is promptly reported. It is gratifying to note that some improvement has already become evident in certain districts as a result of the action taken on the report of the district medical officers of health against village headmen and village watchmen for neglecting to furnish information in regard to the appearance of an epidemic disease.

Only 19 deaths occurred from cholera and no case of plague was reported. As a precautionary measure

nearly 200,000 anti-cholera inoculations were carried out and over a million rats were destroyed. Survey work in leprosy has been carried out systematically and 21 districts have now been covered. In order to discourage lepers belonging to other provinces from coming to the Punjab, Government have decided that a leper home will not be entitled to a grant in respect of a non-Punjabi patient admitted in future, unless at the time of his admission he was certified by the civil surgeon of the district to be in a dangerously infective condition. Anti-hookworm survey was conducted in certain tahsils of the Sialkot and Amritsar districts; and 118,636 patients were treated as compared with 87,863 in 1938 and 49,423 in 1937.

The outstanding event of the year was the commencement of work on the Lahore Drainage and Sewerage Scheme which, when completed, will effect remarkable improvement in the health of the capital of the province. In four other towns drainage schemes were in progress and in five towns they were completed. Water-supply schemes were completed in nine towns. For sanitary works in villages, such as the construction of proper platforms for wells to prevent the water from contamination, the sinking of new wells and the paving and drainage of village streets a sum of Rs. 2½ lacs was allotted by Government. A condition was imposed that the villagers would contribute in labour, material or money one-third of the cost of any work financed under the scheme. The cheerful acceptance of this condition is a heartening sign that the villager is not indifferent to environmental hygiene and is anxious to live in healthy surroundings.

Eight new maternity and child-welfare centres were organized during the year bringing the total to 102.

Refresher courses were held at most of the centres for certificated *dais* in order to prevent any deterioration in their knowledge or standard of work. The number of *dais* under training was 2,593 and certificates after completion of training were obtained by 627 *dais* as compared with 563 in the preceding year.

The Public Health Department is to be congratulated for its excellent work in the Hissar district where, owing to the prevalence of scarcity conditions, new and difficult problems arose which required special energy and imagination. The resistance to disease was low and health conditions in general were a matter of deep concern. The food which was available to the famine-stricken population was not only scarce, but also lacking in the necessary vitamins with the result that deficiency diseases, such as scurvy and night-blindness, appeared and had to be combated. In order to secure co-ordination in preventive and curative measures all rural dispensaries in the district were transferred temporarily to the control of the public health department. Special treatment centres were established and arrangements were made for the visiting of the sick in their villages by medical officers. Vaccinations and anti-cholera inoculations were carried out vigorously; while deficiency diseases were brought under control by the free supply of germinated grain.

It was stated last year that Government were engaged on the consideration of a proposal that vegetable *ghi* should be allowed to be sold only if it bore a distinctive colour. Legislation to this effect has now been passed and a rule has been made that no artificial *ghi* shall be sold, or offered or exposed for sale, or kept in possession for the purpose of sale, unless it is coloured with Oil Orange E in the prescribed degree.

## Current Topics

### Methods Used for Improving Athletic Performance

(From the *Journal of the American Medical Association*, Vol. CXV, 12th October, 1940, p. 1281)

THE term 'doping' was originally used to describe methods designed to increase the functional efficiency of athletes by means of highly active drugs. Now it is employed to describe any method of improving athletic performance temporarily either during training or in connection with competitive events. Boje has classified such substances into four groups: food preparations, oxygen, artificial sunlight and pharmaceutical substances.

Most of the food preparations, especially dextrose or sugar, which provide calories in a readily acceptable or otherwise suitable form are unobjectionable medically, Boje feels. The evidence for the use of lecithin is not convincing and there seems to be no reason why it should be recommended for improving athletic performance. Similarly there is no experimental basis on which to recommend the use of yeast, although it does not appear to be deleterious. Conclusive evidence on the rôle of liver preparations in muscular work and its efficacy for increasing physical energy is also lacking.

Phosphates which have been employed can often cause a purely subjective feeling of freshness and zest for exercise which may amount to a condition of euphoria. Boje concludes that phosphates taken in quantities exceeding the amounts found in a normally varied diet can probably increase the output of the organism. Although there is considerable loss of salts in heavy physical effort, this is probably insufficient to warrant administration of salts except in prolonged contests. Alkalies, usually in the form of sodium carbonate, have also been employed. Before deciding to administer them, attention should be given to the fact that the change produced by exertion in the pH of the blood and its carbon dioxide tension influences

among other things the regulation of respiration. Further, the administration of alkalis by mouth constitutes such a violent interference with the whole pH regulatory system that it is as likely to be detrimental to the maximum physical output as the reverse. For a small group, such as aviators and mountaineers, ammonium chloride can be considered as an agent capable of increasing functional capacity. Other than for occasional slight local irritation, there can be no medical objection to its use.

The use of pure oxygen as a 'dope' has been discussed from time to time. It may be granted that if it is administered immediately before the start of a contest, especially in the case of underwater swimming, it may exert some favourable effect. Nevertheless Boje feels that most athletes and sports leaders have a fanciful and confused idea about the meaning of 'oxygen priming' and that it is highly questionable whether the inhalation of oxygen is of any advantage in ordinary sports events.

Much has been said recently about the value of ultra-violet rays in connection with athletic training. Certainly if administered in suitable doses ultra-violet radiation should not produce any dangers, although athletes who are not used to ultra-violet rays should refrain from exposure immediately before taking part in competitions.

Pharmaceutical substances have been used in athletics based on their influence on the nervous system either as stimulants or as soothing agents. The toxic action of alcohol so overshadows its other effects that its rôle as a source of energy is of little athletic importance. Ether has been included by some as a 'doping' agent but its use does not appear to assume any real importance in connection with sports. 'Smelling salts', usually consisting of a solution of ammonia and of ammonium carbonate combined with ethereal oils, is popular in the prize ring and can be pronounced harmless.

Cocaine is one of the oldest known forms of 'dope', although the extent to which it is now used by athletes is unknown. Leaving aside the question of whether or not it affects metabolism favourably, its influence on the central nervous system, which constitutes the motive for its use as a stimulant, cannot be questioned. Cocaine is effective in removing the sensation of fatigue and can in this manner undoubtedly raise the level of performance in the course of prolonged effort. This mechanism, however, is dangerous; it may have acute intoxicating effects when used in large doses. Its repeated use engenders addiction. Cocaine should never be used in connection with athletics.

Caffeine and other purine derivatives, although widely used as stimulants in connection with physical and mental effort, do not appear to have any established effects in connection with brief physical effort. Definite conclusions cannot be derived from the few available experiments on extended exercise. Furthermore, it is difficult to gauge how far coffee, chocolate and cocoa given to athletes in normal therapeutic doses as a physical stimulant can endanger their health. It seems likely that any substance capable of stimulating the body to exertion beyond the normal limits of fatigue set by the body will prove injurious.

Amphetamine sulphate is much more capable than caffeine of eliminating the sensation of fatigue; the overwhelming evidence of its toxicity, together with the fact that it is not definitely established that performance is improved, indicates that this substance should not be used in connection with athletics. Moreover, the application of extra stimuli or a weakening of natural powers of resistance in organisms undergoing a severe strain must involve risks.

The group of drugs including valerian, bromides and barbituric acid derivatives can be included, but there seems to be no danger of abuse among athletes since every one of these substances has powerful fatigue-producing properties. Digitalis and glyceryl trinitrate likewise can be readily eliminated both because of insufficient evidence of their 'doping' properties and because of their toxic effects. Nikethamide and metrazol have been employed by athletes because of their stimulating influence on the circulation and the central nervous system, which produces a definite subjective feeling of freshness in the tired organism. There is, however, nothing to show that recovery is improved and there are deleterious effects, especially in the convulsive properties of both substances. The use of such products by athletes should be definitely avoided. Finally, although various endocrine products have been tried the evidence on this subject is so flimsy that their use should be avoided, since it may involve dangers the extent of which cannot be evaluated.

Medical advisers must naturally strictly forbid the use of any agent suspected in any manner of being deleterious or any substance which may cause the least direct danger of whipping up the organism to extreme exertion. Although there can be little objection to the use of nutrient agents, of vitamins and of oxygen, the medical adviser should also do everything he can to discourage the use of costly and ineffective substances.

## Treatment of Bronchial Asthma

By C. H. EYERMANN, M.D.

(From the *Mississippi Valley Medical Journal*, Vol. LXII, July 1940, p. 119)

By bronchial asthma is meant an affliction marked by recurring paroxysms of wheezing dyspnoea more pronounced in the expiratory phase, cough, and a sense of constriction in the chest due to pathology of the bronchioles. The conception of allergy has brought about better clinical differentiation of those who wheeze so that bronchial asthma can be divided on the basis of aetiology and, perhaps, mechanism into two broad classes: allergic in which specific sensitization can be proved and non-allergic in which the patient corresponds symptomatically to the allergic group but in

whom no specific factor can be discovered. The advantage of the classification is that it indicates the application of logical therapeutic measures which have resulted in increasing the therapeutic efficiency in bronchial asthma by 5 to 50 per cent during the last three decades.

The treatment of both types of bronchial asthma resolves itself into the subjective relief of the paroxysmal wheezing dyspnoea and the removal, or modification, of its cause. The plan of treatment depends upon the phase of the disease at the time of observation, the aetiological agent and upon what kind of a patient has the disease.

The successful management of the acute paroxysm of bronchial asthma can be undertaken without knowledge of its aetiology and is dependent upon the subcutaneous injection of epinephrine hydrochloride 1:1,000, probably better known as adrenalin. Except in those who have developed a tolerance for it, doses up to 0.3 c.cm. are as effective and without the unpleasant and sometimes alarming side actions of the larger doses. A satisfactory method of using the drug is to fill the syringe with 0.5 c.cm. more or less, and with the syringe remaining in place, to inject one minim or 0.1 c.cm. a minute until the attack begins to subside or until beginning physiological effect is noted by pallor, which is often first seen about the nose by tangential light, by fibrillary muscle tremor, or by palpitation. When physiological effect is obtained, there is no need to administer more epinephrine even if there has been no improvement in the attack. In an emergency, however, one need not be concerned with overdosing, and enough should be given to produce the desired effect. In instances of extremely severe bronchospasm it is possible to give by slow continuous subcutaneous administration, several cubic centimetres of epinephrine without inducing side effects.

Ephedrine and the oral inhalation of adrenalin 1:100 solution by means of an all-glass nebulizer are useful only for mild attacks; attacks which are more a discomfort than a paroxysm of bronchospasm. When these are not at hand, hot strong black coffee sipped slowly, emetics and measures to induce belching, inhalation of the fumes of burning stramonium leaves, and enemata will also bring about relief. Acetyl salicylic acid is used by many, is often helpful but is treacherous. The frequency with which it induces severe bronchospasm forbids its indiscriminate use and it should not be employed until one is certain beyond a peradventure that it will not induce of itself or increase an already existing bronchospasm. In these mild attacks, sedatives of the hypnotic series will be of help. They, too, should be used with discernment because they have been known to induce bronchospasm. More often they are combined with ephedrine to overcome its side effects and so there is a small measure of safety, if idiosyncrasy to them exists, as well as the advantage of their possible synergistic action.

## MANAGEMENT OF PATIENT

The management of the patient with frequently repeated paroxysms of bronchial asthma revolves about the drug treatment of the paroxysm, the maintenance of nutrition, and the search for the causative agent. Experience has shown that this type of case becomes free of bronchospasm more rapidly in a hospital when the usual extrinsic causes (feather, orris root, wool, cottonseed, insecticides, animal pets, house dust) can be avoided; the nutritional status more readily maintained, and diagnostic measures employed without effort to the patient. Rapid improvement under such circumstances is presumptive evidence of an environmental factor. Some cases require, in addition, short periods of starvation or some type of trial diet before relief is obtained. In these instances, one assumes that an ingestant may be an added aetiological factor.

Generally, the asthmatic paroxysm responds to these symptomatic measures. In a small percentage, the patient remains in a constant asthmatic state despite environmental change, dietary manipulation, and subcutaneous administration of epinephrine. Soon the effect of epinephrine is transitory, even with increasing

dosage and shorter intervals of administration. Finally even large doses fail to relieve, while at the same time they increase the nervous irritability and produce palpitation, tremor, weakness, and pallor. Now one has the clinical condition which is called status asthmaticus or intractable asthma. The slightest exertion, as well as eating, drinking, or coughing increases the already existing discomfort. Anoxemia, exhaustion, fear, and overdosage with epinephrine are the factors which aggravate the condition.

On physical examination, there is pulmonary dilatation as shown by great hyper-resonance and absence of downward expansion at the bases, with diffusely distributed inspiratory and expiratory wheezing upon easy breathing. When the patient has had a great deal of epinephrine there is also tachycardia, occasionally with extrasystoles, cold, clammy extremities, anxious expression, a certain amount of hyperkinesism, and some degree of cyanosis of the lips and nail beds. Such patients are dehydrated and undernourished because their dyspnoea does not allow sufficient amount of drink or food and usually that which is swallowed increases their discomfort so that the will to swallow is weakened. All of this goes to make up a clinical situation suggesting a fatal outcome.

The therapeutic indication for this situation is the absolute minimum of physical activity, control of the cough, correction of the anoxemia, and liquefaction of the sputum, and can be treated by one, by a sequence, or by a combination of several therapeutic plans. Irrespective of the plan employed, discontinuance or great reduction in dosage of epinephrine should be part of the treatment.

#### MEDICINAL THERAPY

One of the best methods of interrupting the cycle of attacks in status asthmaticus is by means of the continuous inhalation of a mixture of 80 per cent helium and 20 per cent oxygen through the specially designed mask of Boothby, Lovelace and Bulbulian. This method decreases the amount of effort required to breathe, but there is no immediate effect upon the bronchial spasm, cedema, or secretions. It requires from 12 to 48 hours of constant inhalation to bring about improvement—the time required seemingly dependent upon the length of time the patient has been in status. As in all other types of therapy which interrupt the cycle of attacks, small doses of epinephrine again become effective during the ensuing improvement.

Aminophyllin, in dosage of 4 to 8 grains in 10 c.c. of glucose or normal saline, given very slowly intravenously by means of a 22-gauge needle, gives prompt relief in some instances. When the relief is temporary it can be repeated. The manner in which it induces relief is not known.

Anæsthesia with ether and olive oil by rectum will break the cycle in status asthmaticus in about 50 per cent of cases. The average adult dose is 5 to 7 ounces of a mixture of equal parts of pure olive oil and surgical ether. It should be given without the usual pre-anæsthesia medication because of the frequent harmful effects of the ordinary dosage of morphine, and can be given without preliminary cleansing by gravity or by a syringe, a few cubic centimetres at a time until anæsthetized. The duration of the anæsthesia is usually several hours, and after one-half to one hour of anæsthesia, epinephrine in small doses again become effective. It should not be used as a matter of last resort and only in conjunction with supportive measures.

In lieu of these methods or as auxiliary measures, drugs that will control cough or induce rest will help the patient to survive until the status asthmaticus terminates. When cough is not a prominent part of the symptomatology, sedatives of the hypnotic series are helpful when given to physiological effect. Chloral hydrate, chlorotone, and the bromides are the safer drugs to use because they have not in my experience nor have they been reported as inducing bronchospasm. Barbitol and its derivatives are valuable but should not be given in full dosage until one is certain that hypersensitivity to them does not exist because

they frequently induce and thereby increase already existing bronchospasm. In those who have a short, frequently repeated, unproductive cough, when all other methods fail, morphine is useful in small doses provided no idiosyncrasy exists. The cough reflex is depressed by doses which are too small to exert hypnotic action so that one should use the smallest dose that will serve the purpose. It should not be employed more frequently than is necessary to maintain the required degree of control of coughing. The repetition of the single effective dose should not be at stated intervals but according to the needs of the patient and, to avoid accumulative effect, the dose should be reduced as soon as there is alleviation of symptoms. It should never be given in a customary dose of 0.015 gm. ( $\frac{1}{4}$  grain) and never combined with atropine. The exact initial dose necessary for relief of cough cannot be stated because it varies with the individual and with the intensity of his symptoms, but lies between  $\frac{1}{32}$  and  $\frac{1}{12}$  of a grain of morphine for the adult; if idiosyncrasy exists even this dosage is dangerous. If the cough is not allayed by several injections at three or four-hour intervals a small increment in dosage can be tried. During the period of morphine administration the respiratory rate must not fall below 20 per minute. It is unusual to require  $\frac{1}{4}$  grain (0.015 gm.) morphine during twenty-four hours as a total dosage. In some, better results are obtained by combining the morphine with small doses of epinephrine.

As a rule status asthmaticus terminates successfully when large amounts of sputum, usually purulent, are coughed up so that adequate treatment of the dehydration serves the purpose of correcting deranged metabolic processes and liquefying the sputum, and should be instituted simultaneously with, and be a part of, whatever therapeutic plan is being used. Fluids should be given parenterally and orally, if possible, the amount, type, and method of administration being determined by the exigencies of the clinical situation. Co-existing abdominal distension should be relieved by a small catheter left in the rectum to allow of the easy expulsion of gas and by enemata as soon as the condition of the patient permits. Cyanosis, when present, should be corrected by oxygen inhalation.

#### ÆTIOLOGICAL FACTOR

When the cause of the allergic bronchial asthma has been determined, all that is necessary to bring about a clinical cure is the absolute and complete avoidance of the offending substance. If an ingestant, it should not be eaten and, if an inhalant, it should not be inhaled. There is no drug which will permanently alter or prevent the effect of the absorbed allergen in the hypersensitive individual. If the causative food is essential to the maintenance of nutrition, oral hyposensitization should be tried. Occasionally it is successful and it is more often, than by hypodermic injection. One begins by feeding minute amounts daily and increasing the amount by small increments at intervals of five days until a satisfying amount is eaten. Recurrence of symptoms from one of these increments necessitates reduction of the dose to the one at which no symptoms were produced, followed by gradual approach with smaller increases in amount to the dosage which had previously induced the symptoms. If the inhalant cannot be avoided, hyposensitization injections will be of benefit in the majority of instances, and it is emphasized that specificity is the all important determinant for success with these injections. No amount of injections of house dust will help a patient hypersensitive to orris root.

When the asthma has induced pulmonary emphysema or there is an associated infection of the bronchi or paranasal sinuses, the diagnostic problem is confused by the occurrence of bronchospasm unassociated with demonstrable absorption of allergen and the therapeutic problem is complicated by the necessity of appropriate therapeutics for the associated conditions. Such therapeutics, whether medicinal, climatic, psychic, or mechanical, is only to alleviate the effects of specific hypersensitivity and will vary with the experience, ingenuity, and enthusiasm of the therapist.

The therapeutic problem in those who appear to have non-allergic asthma is difficult. While one is treating the usual accompanying complications, one is bewildered by the diverse stimuli that induce the bronchospasm and tormented by the thought that hypersensitivity exists despite negative cutaneous reactions, such being due either to our failure to test with the proper allergen or to immunologic vagaries. Successful therapeutics in these cases requires a thorough knowledge of internal medicine and its diagnostic handmaiden allergy, with an expanding experience with asthmatic patients and their psychology. Practically, one decides as to the care of foci of infection, the use of vaccine, either stock or autogenous, the employment of non-specific desensitization with peptone, with milk, with typhoid or colon bacilli, with tuberculin, and such miscellaneous forms of therapy as autohæmotherapy, exposure of the various portions of the body to the roentgen ray, physiotherapy, light therapy, hydrotherapy, climatotherapy, endobronchial treatment with bronchoscope, and breathing exercises—all of which have enthusiastic proponents but none of which improve all cases. The multiplicity of therapeutic plans for this type of bronchial asthma mirrors the difficulty in obtaining consistent satisfactory therapeutic results.

#### SUMMARY

One now has enough knowledge of the development of the allergic state and the various symptoms of hypersensitivity to advise prophylactic measures and to practise preventive medicine. This knowledge allows us to advise that the child of parents with allergic manifestations be prevented from absorbing the inhalant, ingestant and contactant allergens most frequently causing clinical allergy; to be alert to the possibilities of allergy, explaining the cause of symptoms which ordinarily might not arouse the suspicion of allergy; perhaps even having a voice in the choice of household furnishings, cosmetics, clothing, drugs, and occupation. As far as the adult is concerned, such advice is part of the active treatment, and his prophylactic treatment is the avoidance of allergic manifestations during childhood and his chronic illness and its inevitable sequelæ.

While one indicates methods of therapeutics and medicinal formulæ, it should be realized that excepting methods of hyposensitization, there is no standardized treatment—that one treats an individual influenced by the distress and the fears incident to a disease reputed to be incurable. The best therapeutic results are founded upon a study of the patient as a whole, considering his heredity, his environment, his peculiarities, and his reactions to discomfort; correcting the abnormalities found by physical and laboratory examinations, evaluating the influence of controlled environments; interpreting the observed reactions of cutaneous testing, of the ingestion of foods, and the administration of drugs in the light of past experience and applying treatment guided by the integration of this knowledge.

### The Present Position of Sulphonamide Therapy

By W. R. THROWER, M.D. (Lond.), M.R.C.P.

(From the *Lancet*, Vol. I, 18th January, 1941, p. 67)

SOME two years have elapsed since the synthesis of any new sulphonamides with striking therapeutic activity, and it is now possible to say with some certainty what particular compounds will do in actual practice and what is the best procedure for tackling infections by organisms within their range of activity.

The beginning of chemotherapy in its present form was the synthesis by Jacobs and Heidelberger in 1917 in New York of a number of azocuprein sulphonamides which were highly bactericidal *in vitro*, and it is something of a medical tragedy that no further study of these and allied compounds was undertaken until 1933. In this year, after experimental work had demonstrated that sulphonamido-chrysoidin was likely to be of value,

this compound was used in clinical medicine and proved to be effective against streptococci of the  $\beta$ -hæmolytic type, meningococci and gonococci. In some respects the ease with which different agents may be tested against  $\beta$ -hæmolytic streptococci in mice has been unfortunate, inasmuch that attention has continually been focused on infections with this organism to the exclusion of the staphylococcus, a much commoner and at present a more lethal organism when it invades the blood-stream. Danger lies in arguing that the same compounds administered in the same way will be required in the treatment of both streptococcal and staphylococcal infections simply because both organisms happen to be cocci. The different course of infections by the two organisms in the human subject shows how distinct they are.

While interest was centred on the action of sulphonamido-chrysoidin on certain streptococci came the fundamental discovery by Tréfouël and others that the activity of this compound lies in its sulphanilamide nucleus, this type of compound being long known to chemists working in the dye industry for its mordant properties. The observation that sulphanilamide was a therapeutically active drug made possible most of the chemotherapeutic research of recent times. Sulphanilamide, while less toxic than sulphonamido-chrysoidin, is a powerful drug, and its indiscriminate use may be fraught with the well-known unpleasant side effects common to all sulphonamides. The benzyl derivative of sulphanilamide (Proseptasine) is active against streptococcal infections, and seems to be less toxic than sulphanilamide. Sulphonamido-chrysoidin, the red compound presented in tablet form as Prontosil Rubrum, is held by some to be a more active streptococcidal agent than sulphanilamide. Possibly because the dye compound is less readily soluble and therefore more slowly absorbed than sulphanilamide its action is more constant, but for this reason in fulminant disease sulphanilamide is the better compound to use. A soluble dye (disodium 4'-sulphaminophenylazo-1-hydroxy-7-acetylaminonaphthalene-3 : 6-disulphonate), marketed as Prontosil Soluble, is also available for therapeutic use. The risk of toxic reactions with these red compounds, apart from the inconvenience of dyes, limits their sphere of usefulness, and new and better drugs have largely superseded them. It has moreover been found possible to prepare a compound of sulphanilamide with a solubilizing group which is suitable for parenteral administration. This drug, whose formula is disodium-para-( $\gamma$ -phenyl-propyl-amino)-benzenesulphonamide- $\alpha$ - $\gamma$ -disulphonate, and which is marketed under the name Soluseptasine, has high antistreptococcal and antimeningococcal potency.

The therapeutic range of the earlier compounds examined is thus limited, and continued search has been made for derivatives of sulphanilamide with wider activity. In 1937 and 1938 there was synthesized a new class of compounds in which one hydrogen atom of the sulphonamide group ( $\text{SO}_2\text{NH}_2$ ) was replaced by various substituents. Four compounds produced in this way deserve detailed attention: Uleron, which is para-aminobenzene sulphonamidobenzenesulphon-dimethylamide; Albucid, which is para-aminobenzene-sulphonacetamide; M. & B. 693 or sulphapyridine, which is 2-(para-aminobenzenesulphonamido) pyridine; and Thiazamide or sulphathiazole, which is 2-(para-aminobenzenesulphonamido) thiazole.

Uleron, originally introduced as an antistaphylococcal agent, has also been used in the treatment of gonorrhœa, but this drug has proved disappointing in the treatment of early infections. A considerable number of cases of severe peripheral neuritis have followed its exhibition, and outside Germany its use in gonorrhœa has largely been abandoned. Albucid has the advantage of seldom causing unpleasant side effects, but it is generally regarded as a less powerful gonococcicide than the other and more popular sulphonamides. The synthesis of sulphapyridine by Ewins and his co-workers was the first outstanding advance after the demonstration by Tréfouël and his colleagues of the properties of sulphanilamide. The outstanding merit of sulphapyridine is its activity against pneumococcal infections



of all types, but it also appears to be the most potent remedy yet available for gonorrhoea and meningococcal meningitis. The fact that it is active against certain streptococcal infections is not surprising, but its routine use for these infections does not seem to be justified when other equally potent and better tolerated drugs are available. Certain cases of staphylococcal infection have responded to the use of sulphapyridine when high concentrations in the blood have been obtained.

The thiazoles are capable of further substitutions in the thiazole ring, to produce methyl and phenyl derivatives. The thiazoles as a class are moderately active against the common pathogens and detailed study of them in the clinical field was deferred until recently when reports from the United States suggested that they were of value in the treatment of staphylococcal infections. These somewhat optimistic reports have not been wholly confirmed in England, but the clinical trials have focused attention on staphylococcal infections as a whole, and on the possibility of using existing sulphonamide compounds in their treatment.

#### NEW APPROACH TO ACUTE INFECTIONS

To obtain the best results from these new remedies it is important to pay less attention to the conventional names of particular conditions than to the underlying organisms. For example, in the past the terms lobar pneumonia and broncho-pneumonia have been arbitrarily used, and little importance has been attached to their bacteriology; nowadays, however, the treatment as well as the prognosis is seen to turn on the nature and type of the organisms, and not on whether the lesion is alveolar or peribronchial in distribution. Fortunately many acute respiratory infections respond to treatment with one or other of the sulphonamides, but when a case is encountered which appears refractory to treatment it is good practice, if this had not already been done, to examine the flora of the sputum and see whether the predominant organism is one likely to respond to chemotherapy at all and, if so, which of the various compounds available is most suitable. In the same way the infecting organism should be determined whenever possible when treating acute infections of the skin or subcutaneous tissues by chemotherapy with or without the help of surgery. The kind of treatment successful in, say, a streptococcal infection is very different from that necessary in one due to staphylococci, for the latter organism is only acted on to any extent by two compounds—sulphapyridine and sulphathiazole—and then only when they are present in high concentrations in the blood conveyed to the affected part.

The haphazard exhibition of these new drugs to all and sundry infections is most undesirable, for there are still a number of infective processes which prove irresponsive to chemotherapy and in these prolonged administration may be not only useless but actually harmful.

#### BACTERIA INFLUENCED BY SULPHONAMIDES

The organisms affected by chemotherapy can be divided into two groups—those which are highly susceptible, and those on which the drugs exert only a moderate activity. In the first group are  $\beta$ -haemolytic streptococci, all types of pneumococci, meningococci, gonococci and certain strains of *Escherichia coli* and *Bacillus pestis*. These organisms are the principal causes of illness commonly attended by a high case-fatality rate. In the second group are a large number of micro-organisms which show a greater or less response to the sulphonamides depending partly on the location of the infection in the body and partly on the manner in which treatment is carried out. An instance of the effect of location is the typhoid bacillus; the typical general disease due to this organism is uninfluenced by any drug, but in the 'carrier state' with persistent infection of the urinary tract sulphapyridine acts almost as a specific. Experimental work provides an explanation of this difference. The typhoid bacillus is only slightly affected by sulphonamides in therapeutic concentrations both *in vitro* and *in vivo*, but is killed by the concentrations

attained in the urine, often amounting to 10 or 20 times those in the blood. With infections due to low-grade streptococci a different process operates, for many strains are fairly responsive to treatment but the lesion they cause has the peculiarity of shielding the organism from effective concentrations of the drug, as in sub-acute bacterial endocarditis, and a somewhat similar mechanism may operate in pneumonia caused by the same organisms.

The common organisms of respiratory catarrhs, with the exception of *Hæmophilus influenzae* and the Friedländer bacillus, exhibit only a sluggish response to chemotherapeutic agents and the diphtheria bacillus not at all. Scarlet fever is not influenced materially by sulphonamides, but they may be strikingly effective when complications arise. Gas gangrene, tetanus and anthrax are often successfully treated with sulphapyridine, but particularly in gas gangrene variations in strains of the organisms make results inconsistent; steps must also be taken to combat the exotoxins circulating. In staphylococcal infections treatment is influenced by the nature of the lesions commonly present and also by the fact that the organism is only influenced by certain sulphonamides in high concentrations. Local lesions in the acute febrile stage respond sporadically to sulphathiazole but there is still doubt about the best way of maintaining an effective level in the blood. For bacteriæmic cases both sulphathiazole and sulphapyridine are valuable when given by intravenous drip of the sodium salt in normal saline, the dosage being controlled by periodic estimation of the blood concentration.

Virus infections, except that causing lymphogranuloma inguinale, are unaffected by existing sulphonamides, although of course they may control concurrent microbial infections.

#### USE OF SERA

The advances of chemotherapy have been entirely in the antibacterial direction, and none of the new compounds affect toxins except in so far as they eradicate their source. On theoretical grounds it is desirable to employ antitoxic sera as adjuvants to chemotherapy, but practical considerations with regard to their administration, apart from the factor of availability in the right place at the right time, do not make combined therapy easy. With the exception of some cases of gas gangrene and acute staphylococcal infections the results of chemotherapy alone are so consistently good that little harm results from failure to administer serum. Much of the danger from infections with gas-producing organisms of a severe type is due to the exotoxins present, the effects of which may be mitigated by good antitoxin. In acute staphylococcal infection there is increasing evidence that the early use of antitoxin with chemotherapy is beneficial.

#### DOSAGE

Chemotherapy has revolutionized the treatment of certain acute infections but the method is still subject to many limitations and it is important that enthusiasms for new things should not exceed knowledge of their application. One patient cured somehow is worth any number of fully investigated dead ones, but patients will always have better prospects of recovery if treated scientifically than by rule of thumb. A methodical approach to the treatment of acute infections is not difficult now that laboratory facilities are readily available for doctors who have neither the time nor the inclination to undertake clinical pathology. If the infecting organism can be identified with precision the appropriate compound can be selected for treating it, but treatment should not be unduly delayed for laboratory reports; the doctor must rely on his clinical acumen to decide the most likely nature of the infection, and make any necessary adjustments later when pathological reports are ready. Close liaison between the clinician and the pathologist is particularly important in the control of obscure or resistant infections, since it is possible to determine by direct test whether a particular organism is influenced by any compound.



Another direction in which clinical pathology can help is by periodical determinations of the sulphonamide content in the blood of patients undergoing chemotherapy. The concentrations of different compounds necessary to attain the optimum effect have been determined, principally by clinical experience, but modifications may be required to meet changing circumstances. When using sulphanilamide a blood level of 10 mg. per 100 c.cm. is required, and with sulphapyridine a level of 5 to 10 mg. per 100 c.cm., except in acute staphylococcal infections when at least 15 mg. per 100 c.cm. seems desirable. Agreement about the levels needed with sulphathiazole has not yet been reached, but in pneumococcal and meningococcal infections they must, it seems, be rather higher than those required with sulphapyridine, and in staphylococcal septicæmia about 20 mg. per 100 c.cm. should be aimed at.

It is a fundamental rule in deciding on the dosage of any sulphonamide that an effective level should be attained in the blood as rapidly as possible and then maintained by regular four-hourly administration. This may be done by giving two or three initial loading doses, consisting of twice the amount considered necessary of maintenance. If oral therapy is impracticable because the patient is vomiting or too ill some form of parenteral therapy must be given. The choice of soluble compounds is more or less limited to three—sulseptasine and the sodium salts of sulphapyridine and sulphathiazole. There is considerable discussion about of the best way of giving these compounds. The difficulties do not arise solely over the question of their pH but also over the best way to get them into the circulation. In severely ill or collapsed patients the peripheral circulation is inactive, so that intramuscular injections may be sluggish in action and be attended by local necrosis, a situation which cannot arise if the intravenous route is adopted. Provided that only one or two injections are necessary little harm is likely to be done by giving them intravenously in the ordinary way, but if prolonged parenteral therapy is required a continuous intravenous drip of the compound dissolved in normal saline is the ideal technique, and has in my experience never been attended by untoward results. Intrathecal injections must never be given.

Clinical practice has shown that the giving of somewhat arbitrary quantities of the various drugs by mouth or injection is on the whole attended by good results. A common cause of failure is that, owing to irregularities in absorption or over-rapid excretion, effective blood levels have not been attained, so that the periodic determination of blood concentrations is an important aid to treatment in many infections. No patient is ever the worse for intensive treatment at the beginning of an infection and a few subsequent days of high dosage. Troubles arise through so-called moderate doses being given, which are usually ineffective and have to be continued for longer than would otherwise have been necessary. If the organism is or has become drug-fast a change to another compound known to be active against the particular infection concerned should be made. A total dosage of between 20 and 30 gm. is sufficient to control most infections.

#### ADJUVANTS TO TREATMENT

The success of sulphonamide therapy in difficult circumstances must not detract from the importance of ancillary methods which will help to overcome the general effects of an acute process. One point particularly requires emphasis—the value of recumbency throughout treatment. As a rule the acuteness of the illness decides this automatically but many less ill patients do take these remedies while walking about. There is a higher incidence of side effects among these people, and it is questionable whether the drugs do much good in the doses given to ambulant patients except in gonorrhœa, where the causal organism is highly susceptible to sulphonamides; even here results are much better when the patients are hospitalized.

#### SIDE EFFECTS

We must distinguish between complications due to the disease and those due to treatment, and must

recognize that many patients now live to develop complications who without chemotherapy would have died before they became apparent. Of the true side effects of chemotherapy a particularly troublesome one is nausea with or without vomiting, and considerable attention has been directed to its causes and prevention. Existing evidence suggests that there is a local action probably in the stomach combined with a central action in the medulla. The local action may be prevented to some extent by suspending the drugs in milk or better still in certain mucilages; with sulphapyridine the regular administration of dilute hydrochloric acid seems to be of value, although just what the significance of variations in the acidity of the gastric juice may be is as yet undetermined. The sulphonamide content of the blood must be a factor in the causation of general reactions, but on present evidence it seems that fluctuations in the blood levels are a more potent cause of trouble than the absolute amount present, since high levels which are constant are better tolerated than irregular lower ones.

#### WOUND SEPSIS

The principles involved in the treatment of wounds are no different from those of the control of acute infections elsewhere in the body by the same types of organism. Interest at the moment centres on the value of applying sulphonamides locally to wounds, but it must be remembered that they are at the same time being submitted to constantly improving surgical technique, and it is impossible to say whether the good results claimed come from the drugs or the surgery. The feeble activity of sulphonamides on micro-organisms in albuminous fluids demonstrated by Fleming makes it questionable whether better results could not be obtained by surgery combined with the administration of chemotherapeutic agents in sufficient amounts by the blood-stream. There is, moreover, growing evidence that various compounds applied direct to a wound produce a local foreign-body reaction in the tissues. The whole question is one requiring much critical study.

## Reviews

**ABDOMINAL OPERATIONS.**—By Rodney Maingot, F.R.C.S. (Eng.). Volumes I and II. 1940. D. Appleton-Century Company, Incorporated, New York and London. Pp. x plus 806 in volume I and pp. vi plus from 807 to 1385. Illustrated

MR. RODNEY MAINGOT is already well known to us in the sphere of medical literature as editor of *Post-Graduate Surgery*. In that book his contribution to the section on abdominal surgery was small, but now he has produced a two-volume work of his own on abdominal operations.

The first volume begins with a section on abdominal incisions, and the most important types are described in detail with the aid of illustrations.

The author's strong criticism of the Battle incision will be endorsed by many. More than one general method of closure of abdominal incisions is given. They are elaborate, if not laborious, the sort of technique one sees employed by a surgeon who has been dogged by a succession of burst abdomens or post-operative hernias.

The main part of this volume, and the best in the whole book, describes the surgery of the stomach and duodenum. The reader is given a wide selection of operations for chronic duodenal ulcer, including six modifications of the Billroth I method, the standard Billroth II operation and three modifications, the Polya operation, and the modern version of Finsterer's operation of pyloric exclusion combined with partial gastrectomy. The selection appears at first sight to be bewildering, but justice is done to each method in turn. The technique of gastro-jejunostomy is to be found in the chapter on pyloric obstruction. *Sic transit*

*gloria*,...! The description follows the usual lines, with the exception that a triple suture line is used.

Parts 3 and 4 are devoted to the surgery of the spleen and pancreas. Volume I ends with part 5, which contains the surgery of the gall-bladder and bile ducts. It is, as one might expect, an excellent and authoritative description.

In volume II the first three parts deal with the liver, appendix and peritoneum. Then come chapters describing hernia. The chapter on strangulated hernia is particularly helpful. A long section on the intestine then follows. It is interesting to note that no method of primary anastomosis has yet supplanted the Mikulicz procedure in colonic resection.

Indeed, the position of the Mikulicz operation has recently been strengthened by the introduction of improved clamps for restoring the continuity of the bowel.

The last chapter of the book is on the subject of post-operative chest complications and is written by Dr. Sleigh Johnson. He reminds us that 10 to 14 per cent of cases of abdominal section suffer from post-operative lung complication, and deplores the lack of progress in respect of this problem. He discusses the aetiology, prevention and treatment of lung complications, the use of heparin being of special interest.

The book has been published and printed in the U. S. A. It has been splendidly done, as befits its importance. Most of the illustrations have been executed by Miss Pauline Larivière, and they are so good that it seems rather unkind to point out that in three figures she has drawn *linæ transversæ* crossing the rectus muscle midway between the umbilicus and the symphysis pubis.

W. McN. N.

**POULSSON'S TEXTBOOK OF 'PHARMACOLOGY AND THERAPEUTICS'.—**By Stanley Alstead, M.D. (Liverpool), M.R.C.P. (Lond.). Third English Edition with new appendix. 1940. William Heinemann (Medical Books), Ltd., London. Pp. xi plus 557. Price, 21s.

Poulsion's *Pharmacology* needs little introduction; it is one of the best books on the subject, it is written with lucidity and precision, and contains numerous invaluable practical hints.

The present edition contains the second *Addendum* to the B. P., issued in June 1940, and gives an account of the new preparations of vitamins and hormones. A special chapter on the sulphonamide compounds, their different preparations, posology, mode of action, and therapeutic indications have made the book very up-to-date and immensely useful, both for students and practitioners. The classification, though not pharmacological, is very ingenious and original.

The book, though suffering from some minor limitations in its scientific and experimental aspects, as also in explaining certain technical things in the light of modern drugs standardization which students are supposed to know nowadays, will definitely prove to be a good addition to our pharmacological library.

J. C. G.

**THE MANUFACTURE OF COMPRESSED YEAST.—**By F. G. Walter, A.A.C.I. 1940. Chapman and Hall Limited, London. Pp. viii plus 254. Illustrated. Price, 15s.

The discovery of yeast as one of the most potent sources of several essential nutritional factors has greatly increased the importance of this substance, already indispensable as a leavening agent and in the fermentation industries. Until the great war yeast was only a by-product of the alcoholic fermentation, but during the last twenty years the manufacture of yeast has developed into a great industry by itself. In spite of vast literature on the chemical transformations brought about by yeast, there has been little mention of yeast production in scientific literature. This book therefore supplies a distinct need.

The book presents a comprehensive description of various processes in the cultivation of yeast, the

principles underlying those processes, and the application of these in practice. The usefulness of the book has been greatly enhanced by inclusion of a description of the plant, together with the specifications of the important units, vessels and fittings. A chapter is devoted to dried yeasts and yeast foods, but unfortunately the quality of yeast from the point of view of its content of various vitamins finds little mention. The book however represents a valuable volume on the subject of the cultivation and manufacture of commercial yeast.

**DEBATABLE TUMOURS IN HUMAN AND ANIMAL PATHOLOGY.—**By W. F. Harvey, E. K. Dawson and J. R. M. Innes. 1940. (Cancer Research Memoirs No. 1.) Published for the Cancer Control Organization of Edinburgh and South-East Scotland by Oliver and Boyd, Edinburgh (Tweeddale Court). Pp. vii plus 124. Illustrated. Price, 10s. 6d.

This is the first volume of the cancer research memoir series published by the joint efforts of the research laboratory of the Royal College of Physicians of Edinburgh, the cancer control organization of Edinburgh and South-East Scotland, and the Institute of Animal Pathology, University of Cambridge. In this volume they have taken up seminoma, granulosa-cell tumour, mixed parotid tumour, melanoma, lympho-epithelioma, giant-cell tumour, endothelioma, lympho-sarcoma and meningioma.

The choice of the title of the book is befitting the neoplasms which the authors have selected for the purpose of discussion, as their real nature has always remained a subject for speculation. The memoir is the outcome of the study of more than 15,000 tumours in the laboratory of the Royal College of Physicians, Edinburgh. The authors have dealt with nine varieties of tumours in the present volume. They have first given a short but clear-cut definition of the tumour, then a detailed description of its gross anatomy and microscopic structure after which a full discussion of their own views, as well as of the views of notable workers of Great Britain and other countries of the world. After this, they have given a conclusion in which the most modern and accepted ideas have been summarized.

The descriptions and discussions have been lavishly illustrated with innumerable pictures and excellent and convincing photomicrographs. A very commendable feature of the volume is that, although the writers have to some extent dogmatically pushed their own views as well as the views of their own school of thought, they have not forgotten to take other schools of thought into consideration. In this way, the book, though small in volume, is thorough and comprehensive. A very valuable portion of the book is the inclusion, at the end, of a chapter containing an exhaustive literature which the authors have chosen to call 'directional literature'. This will enable the student of tumour pathology to increase his scope of study without having to spend time to search in the literature. This book is full of original ideas and should be possessed by everyone who is interested in neoplastic diseases, surgeon, physician, or laboratory worker.

M. N. D.

**THE MICROSCOPIC ANATOMY OF VERTEBRATES.—**By James I. Kendall, Ph.D., D.Sc. Second Edition. 1940. Henry Kimpton, London (263, High Holborn, W.C.). Pp. 342. Illustrated with 197 engravings. Price, 17s. 6d.

This is an excellent monograph which is packed with valuable information regarding histological problems and will be of great help to microscopists and embryologists. The writer has avoided too much emphasis on mammalian and human materials as the latter are available in a large number of excellent textbooks. In this book one will find exhaustive microscopical anatomy of important non-mammalian tissues.

In biology the conception of cellular independence is a necessity and this has been very well tackled with

stereo-diagrammatic figures. Various tissues originating from germinal layers are grouped separately amongst type specimens of all important classes of vertebrates. The cytomorphosis, histogenesis and organogeny of the mammalian and other vertebrates have been explained in a manner which will be found very interesting and stimulating. The book also contains original touches which enhance its value. Very useful facts are to be found in the chapter on technique in which all the important histological methods are incorporated. For the microscopist this chapter is invaluable.

All the diagrams are very illustrative and other descriptions are convincing. The book is up to date and free from any errors of fact. It is also very easy reading. In conclusion, the book is an admirable one which clarifies a difficult portion of comparative anatomy. The author is to be congratulated for making a very intricate subject so easy to remember and to reproduce.

M. N. D.

**PRINCIPLES OF THE ART OF ANÆSTHESIA (BEING THE LECTURES DELIVERED TO THE STUDENTS OF THE ROBERTSON MEDICAL SCHOOL, NAGPUR).—By S. A. Sharma, B.Sc., M.B., D.T.M. (Cal.). 1941. Published by A. D. Mani, Hiltavada Press, Nagpur (India). Pp. 148. Illustrated. Price, Rs. 2**

AFTER a careful analysis the most generous critic will find difficulty in pointing to any merit in this

book. The reader is unavoidably driven to the conclusion that the personal experience of the author in any but the most elementary forms of anæsthesia is extremely limited. The casual dismissal in four lines of the technique of administration of an endotracheal anæsthetic does not suggest practical knowledge of the subject.

The book abounds with gross inaccuracies such as the statement that the corneal reflex should never be lost in surgical anæsthesia (this, incidentally, is contradicted three pages later). Nitrous oxide is described as an explosive gas. Again, it is said that exhaled nitrous oxide cannot be rebreathed. Has the author never heard of the carbon dioxide absorption technique? In the introduction the author announces that the book has been written for the enlightenment of his students. In which case some of his statements are frankly dangerous. For example, he says blandly that a *double* dose of avertin may be given in cases of toxic goitre.

The book is almost devoid of any real practical advice even in the simple administration of ether and chloroform by the open method. A student, knowing nothing of how to set about giving a general anæsthetic, will still know as little when he has read the book.

Apart from the subject-matter, the misprints and spelling mistakes are so numerous as to make the text scarcely readable. At the end of the book there are three and a half pages of errata, which cover only a small proportion of the total mistakes.

An unfortunate addition to the already swollen ranks of medical literature.

## Abstracts from Reports

### THE PASTEUR INSTITUTE OF SOUTHERN INDIA, COONOR. ANNUAL REPORT OF THE DIRECTOR TOGETHER WITH THE THIRTY-THIRD ANNUAL REPORT OF THE CENTRAL COMMITTEE OF THE PASTEUR INSTITUTE ASSOCIATION, 1939-40

DURING the year certain important changes were made in the medical personnel of the Institute. An arrangement was made with the Government of India for a Medical Research Department Officer as Director, and for a specially trained officer of the Indian Medical Department as Assistant Director. The services of two sub-assistant surgeons of the civil medical cadre of the Government of Madras were withdrawn. The special rabies research officer appointed in 1937 was taken on the permanent staff of the Institute as senior medical assistant, and a junior medical assistant was recruited.

At the request of the Director-General, Indian Medical Service, the Central Committee agreed that the Pasteur Institute, Coonoor, should be included in the list of Training Centres for I.M.S. officers on condition that no expenditure to the Association would be involved.

The reorganization of the laboratories which was commenced in 1938 was completed during the year. Equipment essential to the proper functioning of the laboratories was provided in so far as funds permitted, but additional equipment will have to be furnished as funds become available.

Numerous additions were made to the library by purchase, gift and exchange.

The standardized system of antirabic treatment which was introduced at the Pasteur Institute, Coonoor, in 1933, was reviewed after five full years' working. Analyses of the data collected during this period indicated the advisability of adhering to the practice of giving larger doses of antirabic vaccine to human patients estimated to be at greater risk of contracting rabies. At the same time, sufficient evidence became available to justify the adoption of a simpler classification of patients with a corresponding reduction in the number of graded courses of treatment hitherto

employed. In consultation with the directors of other institutes in India a revised and simplified system of treatment was introduced which allowed of the classification of patients into three classes.

The revised system of antirabic treatment was introduced with effect from 1st December, 1939.

The antirabic vaccine employed for the treatment of human patients was a 5 per cent suspension of sheep-brain (Paris strain of fixed virus) in carbol-saline prepared by Semple's method. A total of 1,455,556 c.cm. was manufactured during the year.

During the period under review, 425 patients received a complete course of antirabic treatment at the Institute (398 Asiatics and 27 Europeans). Incomplete courses of treatment were also given to 56 patients of whom 27 were absolved from further treatment after the possibility of rabies in the biting animal had been excluded. The remainder absconded.

The treatment given at the various subsidiary centres was similar to that administered at the Pasteur Institute, Coonoor. The various centres returned 10,374 case cards for patients treated during the period under review. Of these, 8,021 received a complete course of treatment and 2,184 were incompletely treated. The remainder were absolved from further treatment as the possibility of rabies in the biting animals was excluded.

Only 21 deaths were recorded among the 10,205 patients who received complete or incomplete courses of treatment giving a mortality rate of 0.2 per cent. All of the 21 deaths reported during the year occurred among Asiatic patients. Death followed dog-bite in 20 cases and fox-bite in one case.

### General laboratory work

In response to the demand for the services of a general medical laboratory in this part of India, the Institute has continued and extended facilities for work of this kind. Routine laboratory examinations were carried out on a large scale for the benefit of hospitals, dispensaries and practitioners.

Diagnostic tests carried out during the period under review covered a wider field than ever before.

*Research work in rabies*

The antirabic vaccine at present in use at this Institute is a 5 per cent suspension of the brains of sheep inoculated with the Paris strain of fixed virus prepared by Semple's method (phenol vaccine). This vaccine while satisfactory from the point of view of a low associated mortality among treated cases necessitates the administration of large doses over prolonged periods—patients exposed to the risk of rabies infection may receive as much as 10 c.c.m. daily for 14 consecutive days. The large amount of nerve tissue (foreign protein) which the vaccine contains is believed by some workers to be the cause of the rare, but serious, complication of post-treatment paralysis (paralytic accident). It would obviously be desirable to produce a vaccine of at least equal efficacy which would be as free as possible from foreign protein and which could be administered in smaller doses over a shorter period of time.

Preliminary experiments were undertaken to investigate whether the excess of sheep-brain protein could be eliminated from the vaccine without impairing its antigenic value. It was found possible by precipitation at the isoelectric point to eliminate a large proportion (about 80 per cent) of the foreign protein present in suspensions of sheep brain. For this purpose suspensions of fixed virus brain were prepared in buffer solution adjusted to pH 4.4.

The immunizing properties of (1) the clear supernatant (clear vaccine) resulting from isoelectric precipitation of sheep brain suspensions of varying strengths after adjusting to pH 7; (2) the precipitate remaining after isoelectric precipitation in buffer solution the virus being rendered avirulent by incubation at 37°C. for 24 hours at pH 5, and the precipitate resuspended in the volume of saline necessary to give a resultant total protein content equal to that of 5 per cent phenol vaccine, and adjusted to pH 7; (3) 5 per cent phenol vaccine was investigated in a large series of experimental animals. Results so far obtained have shown that the clear vaccine had an immunizing value at least equal to that of 5 per cent phenol vaccine when the total protein content of the clear vaccine was equal to, or half, that of the phenol vaccine. The resuspended precipitate, however, gave very inferior results.

The clear vaccine prepared by the method described above appears to be relatively non-toxic. Large doses have been administered to experimental animals both intravenously and subcutaneously without producing toxic manifestations. It has been administered to human patients in large doses by the intravenous and intrathecal routes without producing any untoward effects.

Attempts have been made to produce hyperimmune serum in sheep by repeated injections of rabies virus. Serum has been obtained which is capable of neutralizing rabies fixed virus *in vitro*. Antibodies were detected in the euglobulin and pseudoglobulin but not in the albumin fractions of this serum. The effects of large doses of serum concentrate from hyperimmune serum on early cases of rabies is under investigation.

A research unit known as the Protozoal Parasites Enquiry was attached to the Pasteur Institute, Coonoor, at the end of 1933. This unit is entirely financed by the Indian Research Fund Association.

The initial activities of the enquiry were directed to establishing colonies of experimental animals, strains of parasites, etc., but some interesting investigations have already been completed. Much attention has been given to a study of the mechanism of defence against malaria.

*Nutrition research laboratories*

An independent enquiry financed by the Indian Research Fund Association has been working on nutrition problems at the Pasteur Institute, Coonoor, almost continuously since 1918. This organization is now known as the 'Nutrition Research Laboratories', a brief account of the history, development and achievements of which is given below.

The first investigations on nutrition to be carried out at the Pasteur Institute, Coonoor, were begun in 1918 when Lieut.-Colonel R. McCarrison, I.M.S., commenced work with one assistant and scanty equipment.

In the earlier days of nutrition research in Coonoor McCarrison discovered that monkeys fed on deficient diets showed striking pathological changes in the walls of the intestine. In a series of experiments on groups of rats fed on diets resembling those consumed by various Indian peoples, McCarrison showed that the growth rate of the animals corresponded with the physical development of human beings living on similar diets. McCarrison's experiments on the vitamin content of Indian cereals, with reference to the problem of beriberi in India, were of considerable value, as were also his observations (with Norris) that the washing of rice causes considerable loss of vitamins and mineral elements. McCarrison's book *Food*, published in 1928, achieved wide circulation and did much to stress the importance of nutrition in relation to public health in India. On Colonel McCarrison's retirement in 1935 the directorship was taken over by Dr. W. R. Aykroyd.

In 1935, a systematic survey of the nutritive value of Indian foodstuffs was commenced as this was considered an essential preliminary to the satisfactory development of public health nutrition work. The practical results obtained have been incorporated in a popular bulletin entitled *The Nutritive Value of Indian Foods and the Planning of Satisfactory Diets*.

In recent years special attention has been given to diet surveys. The main object of diet surveys is to discover the defects of Indian diets and to indicate desirable changes and improvements in the dietary of the people within their economic resources. As the result of these surveys it has become apparent that the diet of the poor rice-eater is essentially the same all over India. In addition to his staple cereal he consumes only very small quantities of other foods, such as pulses, vegetables, fruit and meat. Milk and milk products are taken in negligible quantities, or not at all. In most parts of India the production and consumption of pulses could with advantage be increased. The intake of leafy vegetables is everywhere below the desired level.

In addition to these activities in the field, many laboratory investigations on various aspects of the science of nutrition have been carried out in Coonoor. Numerous experiments have been carried out on rats and other animals to discover the best methods of improving poor Indian diets. Considerable attention has been given to the study of the pathological changes caused in man and laboratory animals by defective diets. The cause of one of the commonest deficiency diseases in India—stomatitis—has been investigated and it has been shown that milk is a valuable curative agent. Much attention has been given to the rice problem in India. A chemical method for assaying the anti-beri-beri vitamin (vitamin B<sub>1</sub>) in rice and other foods was adapted for routine use, and applied to a large number of food samples. It was shown that parboiled rice, unlike raw rice, retains vitamin B<sub>1</sub> and other vitamins after milling and this fact was correlated with the geographical incidence of beri-beri in India. Beri-beri is rare amongst parboiled-rice eaters, and is a serious public health problem only in areas in which raw rice is the staple food. The economic factors underlying the abandonment of the practice of home-pounding rice in the Madras Presidency have been studied by questionnaires and field surveys. The results of these investigations have been incorporated in a monograph entitled *The Rice Problem in India* which has been published this year.

A chemical test for nicotinic acid in foods has been devised in Coonoor and has been extensively employed in this and other parts of the world. The test facilitates the investigation of a common and serious food deficiency disease—pellagra—which can be cured by nicotinic acid.

An important part of the work of the Nutrition Research Laboratories has been the holding of training classes for health workers, the issue of popular bulletins, and the distribution of posters and other propaganda

material. A museum containing exhibits of an educational nature has been established at Coonoor, and popular lectures have been delivered and press notes issued from time to time. The work of the Nutrition Research Laboratories has been closely associated with that of the Nutrition Advisory Committee of the Indian Research Fund Association which is concerned with the development of nutrition work in India, and which has already made pronouncements on various subjects of national importance. The laboratories also collaborate with the Technical Commission on Nutrition of the League of Nations and act as a link between the technical commission and nutrition research organizations in eastern countries.

#### *Malaria investigations*

During the year, an independent research organization known as 'Malaria Investigations' established its headquarters at the Pasteur Institute, Coonoor. This organization is financed by the International Health Division of the Rockefeller Foundation, and in addition to the laboratories and office in Coonoor a field station is maintained at Pattukottai, Tanjore District.

The main objects of malaria investigations are to conduct research on malaria in selected areas in the Madras Presidency, to discover cheap and adequate measures of controlling malaria in these areas, and to demonstrate the economic feasibility of employing them.

#### *Plague enquiry in the Nilgiri District*

At the request of the Director of Public Health, Madras, the Pasteur Institute provided facilities for the conduct of a special enquiry into the epidemiology of plague in the Nilgiris.

The results obtained by the enquiry have shown that the commonest field rodent, the mole rat, and its fleas are a potential danger in regard to the transmission of plague. This species of wild rodent infests the local areas of potato cultivation but the enquiry observed that they appeared to flourish equally well in gardens under other types of cultivation, and it seemed doubtful whether restriction of potato cultivation in and around municipal areas, such as Coonoor and Ootacamund, would be an effective anti-plague measure.

#### ANNUAL REPORT OF THE HENRY LESTER INSTITUTE OF MEDICAL RESEARCH FOR THE YEAR 1940

DURING 1940, the work of the Institute has been maintained along the lines indicated in the previous report, but owing to war all activities have had to be restricted.

A great deal of work continues to be carried out with reference to the special problems and opportunities in China. In the Division of Physiological Sciences our interests are centred in nutrition. This involves two main aspects, an analysis of Chinese diets and ancient Chinese remedies on the one hand and the application of modern knowledge in regard to vitamin and mineral deficiency and chemotherapy. In all the work clinical and laboratory investigation go hand in hand and we are indebted to the Lester Chinese Hospital for its co-operation.

In the Division of Pathological Sciences the same guiding principle is at work, namely, Chinese problems in relation to local opportunities. Owing to military occupation of the surrounding country, field research has had to be curtailed and we are becoming more dependent on our own resources for maintaining the hosts and parasites which constitute so important a condition of this work.

In the Clinical Unit a great deal of time is being spent in carrying out for the whole hospital routine laboratory investigations necessary for diagnosis and treatment. At the same time an attempt is being made by careful records to establish the range of normals as well as the disease incidence in a hospital population, while every opportunity is taken of investigating more fully cases of nutritional deficiency and related conditions.

These reflections naturally lead to a brief review of the evolution of the Institute and some indication of our hopes for the future.

Having decided in 1932 to establish a Medical Research Institute in which teaching would be subsidiary to research and not designed for degrees or diplomas the organization of the institute naturally fell into three divisions of Physiological, Pathological and Clinical Sciences the latter with special relations to the Lester Chinese Hospital. Our relations with the hospital have been more intimate than with any other institution and this is appropriate since it was undoubtedly Mr. Lester's interest in the Shantung Road Hospital which led him to provide not only for the hospital but also for a medical institute. The organization of clinical research has come relatively late in the development of the biological sciences and this is due to the difficulties inherent in the fact that the interests of the patient who becomes a subject for research and of the hospital organization surrounding him, must be safeguarded at all costs. In the case of the Lester Chinese Hospital it was thought that these difficulties might be overcome if the institute controlled one floor of the hospital for research purposes, but the purposes of a mission hospital and of a research institute, both excellent in their way, are hardly compatible with use of the same nursing staff and hospital organization, with the result that some modification in the original plan has become necessary.

The new arrangement whereby the institute makes itself responsible for all laboratory services leaving clinical co-operation to the goodwill of the hospital appears to be more economical for both parties. It is essential however that the results of laboratory research should be clinically tested and that the laboratory programme should be determined by clinical needs. This does not necessarily mean that all laboratory research must be *ad hoc* research. It is very desirable that it should be fundamentally biological but the ultimate purpose of medical research must be kept in view. However, in spite of these difficulties advances in our knowledge of clinical science have been made by members of the Clinical Unit. Dr. Platt was instrumental during his five years' work in definitely adding to our knowledge of nutritional deficiency diseases more especially in regard to the diagnosis and successful treatment of acute beri-beri, a disease previously fatal in a large number of cases.

On the surgical side, Dr. Gordon Thompson and Dr. Gray carried out a full programme of surgical work, contributing to the relief of a large number of patients with advances more particularly in the field of urology.

## Correspondence

### ON THE COMPOSITION OF BUFFALO MILK AND THE DETECTION OF ADULTERATED SAMPLES PASSED AS COW MILK

SM,—Ghosh and Datta in their communication in your May number recorded analytical results for fat, non-fatty solids and lactose content of a number of samples of buffalo and cow milk obtained in Assam. According to them the lactose content of buffalo and cow milk 'varies within a similar and narrow limit', an observation which led them to suggest that the estimation of lactose would help the detection of water adulteration in buffalo milk which is passed as cow milk.

If water alone happens to be the adulterant it can be detected without having recourse to lactose estimation. But, as pointed out by the authors, it will be found helpful in cases where starch emulsions and the supernatant water from boiled rice which do not contain lactose are used as adulterants.

Milk sophistication, unfortunately, has left the realm of primitive methods and is now claiming to be scientific. The recent practice of adding cow's milk starting with buffalo milk by the addition of separated



milk which is a by-product of the creameries. More recently reconstituted milk which is even cheaper than fresh separated liquid milk is being extensively used in some Indian cities (*vide* Report of the Director, Public Health, Bombay, for 1939, p. 59). Since such a case of adulteration involves no reduction in the level of lactose, the suggested legislation to prescribe a minimum standard of 4 per cent for lactose amounts to legalizing the crime cited above.

A second point of interest in the said study is concerning the standard for the fat content of buffalo milk. It was suggested that the present minimum of 6 per cent prescribed in some Pure Food Acts should be reduced to 5 per cent, because the analytical data they presented would justify this.

This suggestion involves a generalization which is contrary to the experience of other analysts. There are a host of factors that control the fat content of milk, and one may not be far from truth if it is pointed out that what holds good in Assam may not hold good elsewhere in India. This suggestion therefore lacks the backing of experience. As it is want of uniformity, where it is possible, in the standards prescribed for certain foodstuffs in Indian Pure Food Acts is well known to all that are connected with their working. In a large measure such a state of things is the outcome of lack of sufficient effort to consult the analytical profession prior to legislation and also due to dependence on the opinion of those who are on the spot. In the circumstances, one would ask if there is any point in suggesting standards which do not achieve the object with which they set out, or propose an alteration to old ones based on incomplete evidence.

G. NARASIMHAMURTY, M.Sc., A.I.C.

PUBLIC HEALTH LABORATORY,  
BOROUGH MUNICIPALITY,  
SURAT,  
25th June, 1941.

#### IDEAL MARRIAGE

SIR,—The letter you have published from Dr. John Lowe in this month's *Indian Medical Gazette*, in which he complains bitterly of my review of Th. Van de Velde's book *Ideal Marriage*, makes me think that it is to Dr. Van de Velde that I owe an apology in that I did not indicate sufficiently clearly the advantages to be gained by reading his book. Shortly, they appear to me to be these, namely the studied clarity of his style, his knack of knowing what it is that youth needs and wants to know about sexual intercourse, and, lastly, the absence of irrelevancies which are so common in textbooks on sexology.

I cannot see Dr. Lowe's point in comparing the number of languages into which this book has been and is still being translated with the number of languages into which the *Bible* has been translated. But if this comparison interferes with his peace of mind let him read for *Bible*, *Uncle Tom's Cabin*.

As an admirer of the teachings of the founder of Islam, I have always been disappointed when reading the *Koran* to note how little Mahomed has been reported to have preached on sex. This is all the more astonishing since Arabs of Arabia are, as a race, the world's sexual athletes.

I am sorry if my review of *Ideal Marriage* gives any reader of it the notion that I regard sexual intercourse as the main, if not the only important, thing in life, for I do not think so. At the same time, as a practising psychiatrist, I am, even at my age, perpetually being shocked by the results that come to my notice through sheer misunderstanding or wilful ignorance of men and women as to their sexual lives. Without a sane attitude towards and a far fuller knowledge of sex, no man can claim the title of 'sapiens', no matter what else he knows.

OWEN BERKELEY-HILL,  
LIEUTENANT-COLONEL, I.M.S. (Retd.).

RANCHI NURSING HOME,  
STATION ROAD, RANCHI  
(BIHAR).

## Service Notes

### APPOINTMENTS AND TRANSFERS

LIEUTENANT-COLONEL H. K. ROWNTREE, M.C., I.M.S. (Retired), has been appointed Director of Production, Instruments and Appliances, with effect from the 17th April, 1941, *vice* Major R. I. Reid, appointed Additional Assistant Director-General, Indian Medical Service (Stores).

On return from leave, Lieutenant-Colonel R. V. Morrison assumed charge of his duties as 1st Physician, Rangoon General Hospital, on the forenoon of the 13th May, 1941.

Lieutenant-Colonel M. L. Treston, Medical Superintendent, Dufferin Hospital, Rangoon, was appointed as Inspector-General of Civil Hospitals, Burma, with effect from the afternoon of the 31st May, 1941, *vice* Lieutenant-Colonel H. S. Cormack, M.C., Officiating Inspector-General of Civil Hospitals, Burma, transferred.

On his reversion to military duty, Lieutenant-Colonel P. D. Chopra, Deputy Inspector-General of Prisons, Punjab, made over charge of his duties on the afternoon of the 16th June, 1941.

The services of Lieutenant-Colonel S. N. Makand, Director of Public Health, C. P. and Berar, have been placed at the disposal of the Government of India, Defence Department, with effect from 21st June, 1941.

Lieutenant-Colonel J. B. Hance, C.I.E., O.B.E., V.H.S., has been appointed as Director of Public Health, C. P. and Berar, in addition to his own duties as a temporary measure, with effect from the afternoon of the 21st June, 1941, *vice* Lieutenant-Colonel S. N. Makand, transferred.

Major W. Scott, Civil Surgeon, Hoshangabad, with headquarters at Pachmarhi, has been re-posted to Amraoti.

Major R. I. Reid is appointed Additional Assistant Director-General, Indian Medical Service (Stores), with effect from the 17th April, 1941.

Major R. I. Reid, Additional Assistant Director-General, Indian Medical Service (Stores), is appointed to officiate as Assistant Director-General, Indian Medical Service (Stores), *vice* Lieutenant-Colonel M. K. Kelavkar, granted leave.

Captain H. B. Wright, Deputy Assistant Director-General (Medical Stores), Karachi, is appointed to officiate as Additional Assistant Director-General, Indian Medical Service (Stores), *vice* Major R. I. Reid.

Major A. M. Sheridan, Civil Surgeon, is transferred from Cawnpore to Naini Tal.

The services of Major E. S. S. Lucas, Civil Surgeon, Dehra Dun, have been placed at the disposal of the Government of India, Defence Department, with effect from 10th April, 1941.

The services of Major W. D. B. Read are placed temporarily at the disposal of His Excellency the Commander-in-Chief, with effect from the 12th April, 1941.

The services of Major R. A. Wesson, Civil Surgeon, Meerut, have been placed at the disposal of the Government of India, Defence Department, with effect from 28th May, 1941.

Major E. A. R. Ardesair made over charge of the Rajshahi Central Jail to Dr. Abdul Majid in the afternoon of 11th June, 1941.

On his reversion to military duty, Major Ilahi Bakhsh, Professor of Pharmacology and Therapeutics, K. E. Medical College, Lahore, made over charge of his duties to a non-I.M.S. Officer, on the 14th June, 1941 (afternoon).



On his reversion to military duty, Major B. S. Nat, Professor of Operative Surgery, K. E. Medical College, Lahore, made over charge of his duties to a non-I.M.S. Officer on the afternoon of the 14th June, 1941.

Major G. B. W. Fisher, 1st Resident Medical Officer, Presidency General Hospital, Calcutta, is appointed to do the duties of the 2nd Resident Medical Officer of the same institution, in addition to his own duties, during the absence, on leave, of Captain W. M. Niblock.

Captain H. S. Maini, A.I.R.O. (Medl.), to be acting Major whilst holding the appointment of Officer Commanding, No. 1 Indian Convalescent Depot. 1st March, 1941.

The services of Captain G. F. Harris, an officiating Agency Surgeon, are temporarily replaced at the disposal of His Excellency the Commander-in-Chief, with effect from the forenoon of the 20th April, 1941.

#### *To be Captain (on probation)*

Edward John Crowe, 23rd April, 1941, with seniority as Lieutenant from 23rd April, 1936, and as Captain from 23rd April, 1937.

The undermentioned officers are called to army service, with effect from the dates specified:—

#### ARMY IN INDIA RESERVE OF OFFICERS

##### Medical

Captain P. B. Sen. Dated 10th June, 1940.  
 Captain S. S. Apte. Dated 18th June, 1940.  
 Captain L. R. Wagholikar. Dated 18th June, 1940.  
 Captain S. J. Sane. Dated 18th June, 1940.  
 Captain S. K. Wakade. Dated 19th June, 1940.  
 Captain H. K. Ambike. Dated 20th June, 1940.  
 Captain P. Papatla. Dated 21st June, 1940.  
 Captain D. R. Sharma. Dated 24th June, 1940.  
 Captain Damodar Singh. Dated 24th June, 1940.  
 Captain K. L. Malhautra. Dated 26th June, 1940.  
 Captain D. N. Basu. Dated 27th June, 1940.  
 Captain K. C. Virmani. Dated 27th June, 1940.  
 Captain W. A. Mirza. Dated 28th June, 1940.  
 Captain P. D. Kapur. Dated 1st July, 1940.  
 Captain J. N. Vasudeva. Dated 5th July, 1940.  
 Captain H. S. Maini. Dated 8th July, 1940.  
 Captain C. L. Malhotra. Dated 9th July, 1940.  
 Captain R. S. Seagat. Dated 9th July, 1940.  
 Captain D. C. Lahiri. Dated 9th July, 1940.  
 Captain C. S. Ahluwalia. Dated 10th July, 1940.  
 Captain Ram Sarup. Dated 10th July, 1940.  
 Captain M. A. R. Khan. Dated 12th July, 1940.  
 Captain N. C. Das Gupta. Dated 12th July, 1940.  
 Captain R. K. Laroia. Dated 12th July, 1940.  
 Captain D. N. Kumar. Dated 13th July, 1940.  
 Captain R. M. Bhartihae. Dated 14th July, 1940.  
 Captain G. L. Singh. Dated 14th July, 1940.  
 Captain M. A. N. Meezuddin. Dated 16th July, 1940.  
 Captain S. M. Pathak. Dated 19th July, 1940.  
 Captain Parduman Singh. Dated 19th July, 1940.  
 Captain D. S. Bhatia. Dated 2nd September, 1940.  
 Captain R. N. Mitra. Dated 5th September, 1940.  
 Captain A. A. Bhambhani. Dated 8th September, 1940.  
 Captain S. N. Paul. Dated 9th September, 1940.  
 Captain Munshi Singh. Dated 10th September, 1940.  
 Captain D. R. Chandihok. Dated 13th September, 1940.  
 Captain B. L. Sahi. Dated 16th September, 1940.  
 Captain S. W. Palsikar. Dated 17th September, 1940.  
 Captain P. N. Sathe. Dated 19th September, 1940.  
 Captain M. L. Blaggana. Dated 19th September, 1940.  
 Captain M. N. Gupta. Dated 3rd October, 1940.  
 Captain S. N. Mittra. Dated 5th October, 1940.  
 Captain N. L. Mukherji. Dated 5th October, 1940.  
 Captain J. N. Plaha. Dated 7th October, 1940.  
 Captain A. K. Banerji. Dated 8th October, 1940.  
 Captain G. S. Babbar. Dated 12th October, 1940.  
 Captain Harnam Singh. Dated 12th October, 1940.  
 Captain M. H. Palnitkar. Dated 13th October, 1940.  
 Captain C. T. Rangaswami. Dated 14th October, 1940.  
 Captain N. Srinivasan. Dated 14th October, 1940.  
 Captain S. C. Bannerjee. Dated 11th November, 1940.  
 Captain A. H. Mallick. Dated 13th November, 1940.

1940.

Captain D. N. Chakravorty. Dated 15th November, 1940.  
 Captain V. N. Khare. Dated 15th November, 1940.  
 Captain T. H. Talwalker. Dated 15th November, 1940.  
 Captain K. Satyanarayana. Dated 16th November, 1940.

Captain K. Raghavachari. Dated 16th November, 1940.

Captain P. N. Sen. Dated 19th November, 1940.  
 Captain G. C. Tandon. Dated 22nd November, 1940.  
 Captain K. T. Thadani. Dated 1st December, 1940.  
 Captain C. P. Shahani. Dated 5th December, 1940.  
 Captain S. P. Maitra. Dated 7th December, 1940.  
 Captain K. L. Aich. Dated 7th December, 1940.  
 Captain K. K. Sirker. Dated 7th December, 1940.  
 Captain P. V. R. Murty. Dated 12th December, 1940.  
 Captain N. G. Patwardhan. Dated 15th December, 1940.

The undermentioned Lieutenants (on probation) are confirmed in their rank, with effect from the dates specified.

#### INDIAN LAND FORCES (Emergency Commissions)

13th June, 1940

S. S. A. Khan. M. Abbas.

14th June, 1940

S. K. Sen. S. Kumar.  
 A. Husain. C. M. A. Raza.  
 B. M. Mukherjee. K. Jha.  
 S. K. Mukherjee. H. Singh.  
 S. S. Sehgal. K. L. Banerjee.  
 S. H. A. Gardezi.

15th June, 1940

R. S. Sahi. B. A. R. Rao.  
 A. K. Dutt. P. R. Das Gupta.  
 D. W. Khot. K. C. Dobhal.  
 M. M. U. Nayar. B. C. Mukherjee.  
 R. V. B. Tampi. A. Krishnan.  
 R. D. Kamat. P. C. S. Srinivasan.  
 S. Bhatia. K. S. Pillai.  
 G. B. Fernandes. C. W. Chacke.  
 P. R. Menon. H. S. Kanwar.  
 S. S. Katdar. M. K. Tyagarajan.  
 N. V. Karve. K. P. Singh.  
 S. A. Aslam.

16th June, 1940

V. Rajagopalan. B. W. Lyall.  
 G. B. Bhattacharyya.

17th June, 1940

K. R. R. Rao. S. G. Rajagopal.  
 O. Francis. T. D. Taravanan.

1st July, 1940

R. L. Mehta. S. Ramalingam.  
 M. N. Khan. K. L. Chhitwal.  
 M. R. Rao. N. C. Bhowal.  
 A. K. Mallik. T. S. Ramamurti.  
 M. Y. Alurkar. S. V. Dalvi.  
 S. K. Sen. P. V. Ramaniah.  
 S. N. Narula. K. John.  
 B. Ghosh. B. Raghavendrachar.  
 A. C. Bhatara. S. D. N. Sinha.  
 M. Singh. A. K. Das Gupta.  
 N. K. Mehra. G. A. Sundaram.  
 T. S. Parmar. R. S. Rao.  
 K. K. Das. K. P. Roy Chowdhuri.  
 F. C. Das. M. K. K. Menon.  
 T. Titus. D. S. Kaicker.  
 S. K. Bhaumik. B. N. Mukherji.  
 A. K. Sen Gupta. N. N. Santhanam.  
 A. C. Ray. M. M. R. V. A. Nambiyar.  
 M. V. Nayar. S. Singh.

2nd July, 1940

O. Prakash. N. Sen Gupta.

3rd July, 1940

A. K. M. Mazhar.

4th July, 1940

M. M. Shrinagesh. H. A. S. Joseph.

5th July, 1940

A. L. Som. S. C. P. Sinha.  
A. R. Tampi. M. S. R. Rao.  
R. Subramanian. N. C. Mukherjee.  
A. P. Ray. A. Mohiuddin.  
M. R. Tatwawadi. N. K. Nag.  
R. K. Chakravarty. A. A. Khan.  
R. Ghose. I. G. Sastry.  
G. C. Sarkar. M. Ilahi.  
M. Imaduddin. S. K. Das.  
G. V. Chaphekar. S. C. Bagchi.  
B. L. Somway. D. N. Rai.  
S. D. Butt. S. M. De.  
P. P. M. Nair. K. M. Rowther.  
G. V. Munje. H. P. Banerji.  
K. S. Seth. A. B. Talibuddin.  
H. D. Varma. S. B. Rabbi.  
S. Ahmad. C. S. Singh.  
B. B. Choksi. P. Dutt.

16th July, 1940

A. K. Mukerji. M. K. Maitra.  
S. K. Bose.

17th July, 1940

A. K. Das.

18th July, 1940

E. R. F. Rebello. K. P. Joseph.  
S. D. Basu. M. A. Paul.

1st August, 1940

R. S. Saksena. R. K. Satija.  
C. Venkaiah. M. Das Gupta.  
M. Ramarao. A. G. Menon.  
P. C. Nedungadi. C. L. Chadha.  
K. P. Anandan. H. L. Anand.  
M. Y. Qureishi. W. G. Aranha.  
K. M. Singh. L. B. Belkhode.  
S. N. Sharma. P. Chandra.  
H. L. Sah. N. C. Chatterjee.  
F. P. Gazdar. N. G. Gadekar.  
S. P. Mukherjee. A. Qadir.  
A. Nath. A. K. Gupta.  
H. A. Davidson. N. Dutt.  
R. S. Dhillon. M. R. Vesuna.

G. C. Chawla.

2nd August, 1940

P. Oommen. S. C. Banerjee.  
K. C. Chaudhuri. S. M. Das.  
S. K. Roy.

15th August, 1940

C. N. Chatterji. B. Barat.  
K. B. Roy. H. C. Sen Gupta.  
M. A. Razak. J. Sen.  
P. L. Khurana. P. Singh.  
E. K. Pillai. A. Dhirar.  
S. K. Misra. M. Suleman.  
A. Chattopadhyay. N. L. Sharma.  
P. K. Das. P. Z. Abraham.  
G. S. Lamba. B. L. Aggarwal.  
P. K. Paul. V. S. Sharma.  
T. V. R. Wariyar. M. M. Sharif.  
R. S. C. Banerji. S. Prakash.  
G. S. Dhaliwal. C. Bhan.  
C. T. Subrahmanyam. K. C. Majumdar.  
R. K. Chatterjee. G. Kumar.  
R. S. P. Sinha. H. S. Malik.  
S. M. Venkatakrishnan. K. S. Rama Swami.  
S. N. Bose. J. N. Dhar.  
S. Pichumani. M. Alam.  
A. Islam. G. A. Aleem.  
U. P. Das Gupta. B. K. Goswami.  
J. Jacob. V. F. Siqueira.

J. C. Sen.

16th August, 1940

N. V. Sridharan. P. B. Bose.  
S. N. Bose. S. K. Das.  
S. C. Chatterjee.

17th August, 1940

I. B. De.

1st September, 1940

Y. S. Bawa. N. Ahmad.  
D. C. Roy. P. S. Viswanathan.  
K. Ramakrishnan. B. L. Kamra.  
P. U. Rao. G. V. Rao.  
K. P. B. Menon. P. Damodram.  
P. R. Raju. B. Ahmad.  
K. C. Ganapathy. K. N. S. Nair.  
T. K. Rithuparnan. S. Singh.  
D. N. M. Rao. S. G. Sundaram.  
K. P. M. B. U. Nayar. A. Jabbar.  
K. S. R. Krishnan. H. K. Lal.  
K. Paidilingam. M. Qamaruddin.  
V. P. Patel. S. L. Rikhye.  
S. Sivarajan. M. H. Qazi.  
G. Das. E. N. C. Benjamin.  
J. R. Sen. S. C. Chatterjee.  
S. C. Sarkhel. D. R. Batura.  
C. C. Menon. T. S. Khurana.  
K. G. Menon. B. Kishore.  
R. I. Ananthanarayanan. B. C. Bhalla.  
A. A. Khan. S. C. Mazumdar.

R. K. Arora

19th September, 1940

M. G. Hyder.

23rd September, 1940

N. M. K. Bhaduri. K. D. Sebastian.  
M. S. Lasker. C. P. Cherian.  
I. C. Misra. M. B. Kekre.  
H. Paul. A. C. S. Nambiar.  
N. A. A. Khan. P. I. George.  
A. S. Baxi. S. N. Basu.  
K. S. Ayyar. B. J. Rao.  
J. J. Dharmaraj. S. C. Ray.  
P. P. V. George. S. K. Ghosh.  
N. Money. K. C. Dube.  
M. I. Giand. R. M. Nadkarni.  
N. E. Sarangapany. B. S. Wagley.  
H. N. Hussain. S. P. Ramakrishnan.  
A. K. Marwat. K. N. Mathur.  
P. N. Banerjee. P. A. Narayan.  
M. Sharma. B. S. Sharma.  
S. M. Q. Hoda. V. R. Bagwe.  
I. S. Jetley. M. R. Thakar.  
K. N. K. Menon. A. Aziz.  
K. Atri. J. H. Patel.  
S. V. Joseph. S. B. Sinha.  
H. N. Dastur. S. Mascarenhas.  
P. P. Kailasam. D. D. Mitra.  
P. I. Jacob. P. Chand.

M. Said.

The undermentioned appointment to an emergency commission is made:—

To be Lieutenant

Leslie Rochfort Flowers. Dated 17th February, 1941, with seniority 1st September, 1939.

INDIAN LAND FORCES  
(Emergency Commissions)

To be Lieutenants (on probation).

1st February, 1941.

Man Singh.  
Tharakal Eroman Unny.  
Venkatesh Raghunath Sane.  
Daran Jamshedji Shroff.  
Maharaj Saran Kapur.  
Pessumal Phundumal Hazari.  
Achyut Bhalechandra Gune.  
Syed Hasan Ahmad.

Nurur Rahman.  
 Mahadev Dattatraya Joshi.  
 Kalpathy Doraswamy Iyer Veeraraghavan.  
 Zafar Ali Sapru.  
 Eruchshaw Behramji Mody.  
 Gurdial Singh Sandhu.  
 Khwaja Abdul Rashid.  
 Madhav Prasad Misra.  
 Deviprasad Ramanikrai Desai.  
 Rehmatullakhan Ahmedullakhan Hakim.  
 Chidambra Manikka Muthu.  
 Hazura Singh.  
 Daljit Singh.  
 Deva Swarup Gupta.  
 Adoor Thimappaya.

2nd February, 1941

Murugappa Somasundaram.  
 Samuel Victor Kail.  
 Narayanaswami Sundaram Pillay.  
 Raman Raghavan.

15th February, 1941

Pasu Pati Rit.  
 Kaithayil George Koshi.  
 Valaudhan Krishna Pillay.  
 Amal Kumar Dutta.  
 Pramode Nath Roy.  
 Nuruzzaman Khansur.  
 Suba Singh Sidhu.  
 Mohammad Saleh Hashemi.  
 Jawaharlal Chatterjee.  
 Parameswaran Subrahmanyam.  
 Ahsan-ul-Haque Minhas.  
 Chaman Lal Sukhija.  
 Dattatraya Raghavendra Shirhatti.  
 Ratn Kaul.  
 Ram Das Pal.

17th February, 1941

Beny Chander Singh.

1st March, 1941

Sohan Lal Sawhney.  
 Devendrarai Navnidhrai Vora.  
 Kandasamy Minakshisundaram.  
 Shambhu Swarup Kapur.  
 Bhanu Narayan Trilokekar.  
 Pilla Narayana Rao.  
 Manikkam Jegaroyan.  
 Santi Kumar Ghosh.  
 Gurpur Narasimha Prabhu.  
 Tirupathur Madhava Rao.  
 Sandur Krishnamurti.  
 Lakhmi Chand Waderha.  
 Paramroj Nadirshah Shroff.  
 Aduthorai-Perumalkoil Krishnier Ramamurti.  
 Mirza Zafar Yab Hussain.  
 Bhubneshwar Prosad Sinha.  
 Padamanur Govinda Rau.  
 Kumbakonam Sadagopalachary Rajagopalachary.  
 Champaklal Trambaklal Shah.

2nd March, 1941

Jitendra Nath Ghosh.

15th March, 1941

Nagarapu Samuel Reddy.  
 Mohammed Anwarul Haq.  
 Jnanendra Nath Mukherjee.  
 Bhabanidas Bhattacharyya.  
 Kartick Chandra Mukherjee.  
 Shad Mohammad Khan.  
 Thyyan Kariadan Narayanan.  
 Amiruddin Ahmed.  
 Parakat Krishnan Kutty Menon.  
 Kidangalloor Velayudhan Pillai.  
 Vinayak Narayan Khadilkar.  
 Hardev Prasad Mehta.  
 Muthuswamy Natarajan.  
 Samuel Bunyan.  
 Aminul Haq.  
 Sushil Kumar Puri.

16th March, 1941

Murali Mohon Singh-Roy.  
 Poduri Ramamurti.  
 Ramesh Chandra Mitra.  
 Nani Gopal Kar.  
 Bhaskar Mahadevan.

17th March, 1941

Bishambhar Nath Kapur.  
 Hari Laxman Marathe.

#### LEAVE

Brevet-Colonel A. M. Dick, C.B.E., V.H.S., Principal, and Professor of Ophthalmology, K. E. Medical College, Lahore, proceeded on leave, preparatory to retirement, from the afternoon on the 2nd June to 29th July, 1941 (both days inclusive).

Captain W. M. Niblock, 2nd Resident Medical Officer, Presidency General Hospital, Calcutta, is granted leave for 6 weeks, with effect from the 16th June, 1941, or the date of availing.

#### PROMOTIONS

The undermentioned officer is granted the local rank of Colonel, whilst specially employed:—  
 Lieutenant-Colonel G. Covell, C.I.E. Dated 31st May, 1941.

#### Lieutenant-Colonel to be Colonel

J. B. Hance, C.I.E., O.B.E., V.H.S. Dated 16th December, 1940, with seniority from 27th January, 1935.

The undermentioned Indian Medical Service Officer is advanced to the List of Special Selected Lieutenant-Colonels:—

Lieutenant-Colonel H. E. Shortt, C.I.E. Dated 14th February, 1941.

#### Major to be Lieutenant-Colonel

R. McRobert. Dated 10th June, 1941.

Major M. G. Saincher to be Acting Lieutenant-Colonel whilst holding the appointment of Officer Commanding, Training Field Ambulance. Dated 16th February, 1941.

Captain A. G. Miller to be Acting Major whilst holding the appointment of Officer Commanding, Indian Convalescent Depot. Dated 15th April, 1941.

#### LAND FORCES

(Emergency Commissions)

Lieutenant to be Captain

E. Fletcher. Dated 12th March, 1941.

Lieutenant (on probation) to be Captain (on probation)

L. R. Flowers. Dated 19th May, 1941, with seniority from 1st September, 1940.

# RETIREMENTS

Lieutenant-Colonel J. H. Smith. Dated 15th March, 1941.

Lieutenant-Colonel H. S. Cormack, M.C. Dated 6th May, 1941.

Lieutenant-Colonel J. H. Hislop, M.C. Dated 9th June, 1941.

## Notes

### BEWARE OF IMITATIONS

THE physicians and members of the allied professions throughout India usually see to it that the layman is warned against buying so-called 'substitutes', but sometimes a doctor will take the chance of prescribing unknown products because he wants to save the patient's money.

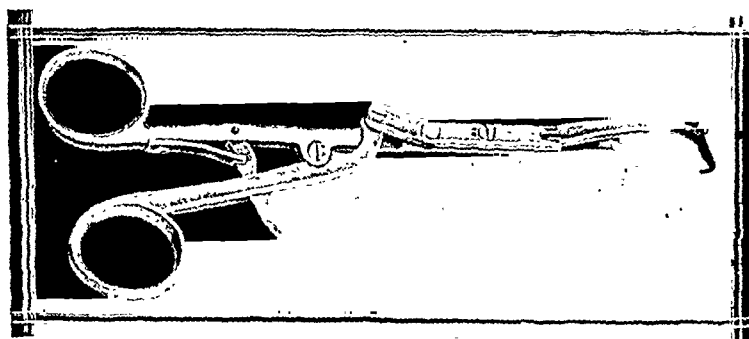
It is during times of unrest and disturbance that the makers of these unknown inferior preparations derive the greatest amount of profit at the expense of the public health. The reliable and ethical practitioner will not deviate from prescribing Antiphlogistine because he has the interest and welfare of his client at heart and will make it his business to discourage the practice of using imitations.

Antiphlogistine has been ethically and scientifically compounded for over 50 years and from time to time it has been imitated, but never has it been duplicated. The silicate of aluminum base used in its manufacture is obtained from private owned mines available only to the Denver Chemical Manufacturing Company.

In acknowledging the confidence which the medical profession has shown towards Antiphlogistine, we suggest that, when prescribing or ordering a kaolin cataplasm for pneumonia, bronchitis or pleurisy, physicians should specify the original genuine product.

### TETRA-TOWEL HOLDING FORCEPS

THESE tetra-towel holding forceps have been designed for me by the Times Surgical Company according to my indications. They are made so that they bite vertically and yet the handles lie flat. In this way the annoying towel forceps handle which continually catches in the surgeon's suture and interrupts work is eliminated.



They are also made with a slight curve in the shaft so that they lie snugly to the curve of the patient's body on either side of the incision. This curve is a further factor in keeping the handles out of the way.

I am extremely pleased with them, after nearly a year's constant use. They are made in stainless steel.

A. T. ANDREASEN, F.R.C.S.,

CAPTAIN, I.M.S.,

Civil Surgeon and Principal,  
Orissa Medical School, Cuttack.

## BOVRIL, LIMITED

*Everybody a food specialist*

I DARE say you will remember the witty doctor's definition of the difference between the general practitioner and the specialist—the G. P. being a man who knows less and less about more and more, while the specialist knows more and more about less and less.

In this sense I think it can be said that we are all becoming food specialists nowadays.

The quantity of some of our foods may be growing less and less, but—thanks to the experts of the ministry of food and others—we know more and more about making the most, and the best, of the still very ample supplies that the merchant service and the navy risk so much to bring us.

One of the points on which the experts through the press and B. B. C. lay great stress is the importance of making meals tempting to the appetite, as well as satisfying from the purely nutritional point of view. Indeed it is being increasingly realized that the nutritional value of food is to some extent dependent upon its flavour. For a tasty appetizing meal is undoubtedly more easily digested and better assimilated than a meal of equal food value but dull and unattractively served up.

### Value of Bovril

It is here that Bovril is proving of real and unique service on the kitchen front. For present conditions give added point to a fact familiar to generations of housewives—that there is no better or simpler way of adding the necessary relish and flavour to an otherwise uninteresting dish than by adding a small quantity of Bovril.

### Bovril, the body's ministry of supply

Though it is both true and important that Bovril adds variety and interest to restricted fare and that 'a little of what you fancy does you good', it must not be forgotten that its effects are valuable physiologically as well as psychologically. I refer, of course, to its action, well established by scientific experiment, to stimulate the flow of digestive juices and so to assist the physical processes of assimilation. It would perhaps be not too fanciful to liken its functions to those of the ministry of supply in the body politic, which does not itself undertake the production of the sinews of war but sees to it that this production proceeds with the greatest possible efficiency and dispatch.

### Bovril in air-raid shelters

In all its long history of public service Bovril has never proved so valuable or been so much appreciated by so many people as it is to-day. This is partly due to the fact that at all times of stress and strain people instinctively turn to Bovril for stimulation and support. But a special reason is to be found in the conditions under which the populations of our great towns are living. Literally millions of cups of Bovril have given warmth and encouragement to those who, night after night, uncomplainingly put up with the inconvenience and discomfort of long hours in air-raid shelters. As a measure for combating the cold, and sometimes the damp, of shelters, and for brightening the spirit of shelterers, our product has proved of the very greatest value, and the public have quickly come to regard it as an essential part of shelter equipment.

### NUNAL

To obtain a prolonged anti-epileptic, hypnotic and analgesic effect, it is essential to use a preparation that

is absorbed evenly, and the body provided with a fairly steady supply of the preparation over a considerable period. For this prolonged therapy, Nunal has been prepared, as the result of an extensive research in our laboratories.

Chemically Nunal is phenyl-ethyl-malonyl-urea.

**Indications.**—The main indication for Nunal is epilepsy. It has a strong hypnotic action and induces sleep even in cases of insomnia due to pain. It can therefore replace morphine in suitable cases. Nunal is suitable for conditions of excitement, mania and alcoholic delirium and is also recommended in the treatment of eclampsia, tetanus, hyperemesis gravidarum. In fractional doses excellent results have been obtained in relieving spasms. For this reason it has gained noteworthy success in bronchial asthma, whooping cough, migraine, etc.

**Dosage.**—It is always advisable to begin treatment with small doses and when the individual dose is once found it should be maintained. Generally in adults of average constitution per oral dose of 0.05 to 0.3 gm. (gr.  $\frac{1}{2}$  to gr.  $\frac{4}{4}$ ) daily is sufficient. The initial dose should not be more than 0.05 gm. (gr.  $\frac{1}{2}$ ), and, when this is well tolerated, higher doses may be given. Women and delicate men receive correspondingly smaller doses. The dosage for children and infants vary according to age and constitution from gr.  $\frac{1}{4}$  to gr.  $\frac{1}{2}$  per diem. When Nunal is given continually, the dosage after a few days should be interrupted for 24 to 48 hours in order to ensure excretion and minimize cumulative effects.

**Contra-indications.**—In cases of asthenia and great debility Nunal should be used with caution and only in small doses. In patients with marked diseases of the liver, heart or kidneys, use of Nunal is not advised.

**Original packing.**—Tube containing 10 tablets of gr.  $\frac{1}{4}$ . Supplied by the Union Drug Company, Limited, 285, Bowbazar Street, Calcutta.

### CALCIUM LÆVULINATE

THERE has been a need in calcium salt therapy for a calcium carrier that was stable in solution, gave a high concentration of calcium ions in the ampoule solution, and was not irritating to the tissues. Oral administration of calcium is often slow while intravenous and intramuscular injections sometimes result in inflammation or ulceration. These and other deficiencies have been observed with the calcium salts of inorganic acids and also, though to a lesser extent, with the salts of those organic acids that have as yet attained much employment in medicine. In recent years studies of the safety and clinical effectiveness of the normal calcium salt of lævulinic acid have drawn attention to this salt and to its many advantages over other calcium compounds.

Calcium compounds can be used in tetany, in tuberculosis, in various types of urticaria and angio-neurotic oedema, in certain types of intestinal and gall-bladder pain, as adjuncts of vitamin D in the treatment of rickets, and to lessen certain transudation phenomena. Calcium lævulinate has been used successfully in effecting rapid but temporary increase in the blood calcium content of tuberculous patients by the intravenous route; reduction of oedema and lowering of clotting time have been observed. It is reported to have been used successfully as an adjunct of gold therapy for tuberculosis, serving to combat concomitant diarrhoeas.

#### Advantages

(1) Its high calcium content (13.1 per cent) compares with that of calcium lactate (13.0 per cent) and more favourably with that of calcium gluconate (8.9 per cent).

(2) Because of its high solubility, stable solutions can be obtained with concentrations as high as 30 per cent or over at room temperatures. Calcium gluconate, in contrast, tends to precipitate even in 10 per cent solution in ampoules.

(3) The solutions are stable at 100°.

(4) The solutions are neutral.

(5) Although it leaves an alkaline ash it does not produce alkalosis. It does not cause acidosis except when used in excessively large doses.

(6) It often assists in the reduction of oedemas.

(7) The ill effects often observed with other calcium salts, such as nausea, loss of appetite, ulceration, inflammation, or diarrhoea, are either entirely absent or markedly reduced.

This product is manufactured by Messrs. Paul Lewi and Company, Inc., 918 N. Fourth Street, Milwaukee Wisconsin.

Sole Indian Agents:—Scientific Supplies (Bengal) Calcutta.

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## Original Articles

### UNUSUAL RHINOSPORIDIAL INFECTION IN MAN

By R. G. DHAYAGUDE, M.D.

Department of Pathology and Bacteriology, Seth G. S. Medical College, Parel, Bombay

RHINOSPORIDIAL infection is not uncommon in Bombay. During the course of the last ten years 1931—1940 inclusive, 45 cases of this infection came under my observation. They have been mostly polypoid growths occurring in the nose, or naso-pharynx. Two of these were uncommon in regard to their anatomical distribution and are likely to be of general interest. The first originated in the urethral mucous membrane; while the second showed generalized rhinosporidial granulomata all over the body.

*Rhinosporidiosis of the urethra.*—Case 1, Moham-medan male, aged 45 years, presented himself at the surgical out-patient department of King Edward VII Memorial Hospital, Bombay, with a complaint that a small mass protruded out of the external urinary meatus while micturating. He did not complain of any bleeding or retention of urine. He had noticed the swelling for about a month.

A pedunculated small polypoid growth was seen protruding from the external urethral meatus for about half a centimetre (plate XXVII, figure 1). On pressure it came out (figure 2) nearly 2 to 2.5 cm. more, and another small growth similar in appearance and feel was seen by its side, the whole appearance being like the bifid tongue of a serpent. By means of a probe it was ascertained that the base of the growth was about 3 cm. above the external urinary meatus. The penis was normal and the lymphatic glands in the inguinal region were not affected. A specimen of urine taken at the time of examination did not show any abnormality.

While attempting to cauterize the growth by diathermy, it snapped before it could be diathermized. The portion of the growth thus obtained was sent for examination.

*Histological examination.*—The growth showed typical features of papillomatous growth of rhinosporidial origin. It consists of a connective tissue core covered over with squamous stratified epithelium. The connective tissue is infiltrated with a large number of sporangia with a thick wall and pinkish hyaline matrix in different stages of degeneration. Underneath the epithelium are seen a few mature sporangia with violet-stained spores on the point of bursting. One or two of them have burst and scattered the spores on the surface and in the adjacent connective tissue. A few early trophic forms of the parasites are seen here and there. The epithelial lining is thinned out in areas in which the sporangia are well developed. The connective tissue in the core is strewn with reactionary inflammatory cell infiltrate consisting of polymorphonuclear cells, lymphocytes, eosinophiles and plasma cells and an occasional

foreign body giant cell disposed around disintegrating sporangia.

The patient was further examined to find out whether he had any primary growth in the nose or naso-pharynx. No lesions could be discovered in these situations.

*Generalized rhinosporidial granulomata.*—Case 2, patient, Hindu male, aged 40 years, was admitted to King Edward VII Memorial Hospital, Bombay, for multiple swellings all over the body, of six months' duration.

The patient was working on a farm about three months ago, but at the time of admission was out of employment. A swelling first appeared on his left lower extremity and from that time on gradually a large number of swellings appeared on his body. He did not remember having suffered from trauma at the site where the first swelling appeared, nor at any other situation where the subsequent ones developed. To begin with the swellings were small, firm nodules in the subcutaneous tissue but as they grew bigger some of them ulcerated, suppurated and broke down. They varied considerably in size. Some of them were only a centimetre in diameter while others were elongated and measured 10 cm. × 5 cm. Some of them were soft and fluctuating while others were firm and well circumscribed. All the swellings were painless and situated in the subcutaneous tissue and were not attached to any deeper structures. None of them showed any connection with nerves. The swellings were situated on the face, thorax, abdomen, back, gluteal region, and particularly large ones on both the superior extremities. As will be seen from the photographs (figures 3 and 4) those situated on the thorax, hypogastrium, back and right shoulder had ulcerated and formed pedunculated masses. Those on the face, right forearm and the gluteal region were just breaking through the skin. The rest and especially those that formed large masses on the arms had an intact integument. The hind view shows them well marked on the dorsal aspect of the left arm and forearm. One such large mass situated in the right arm was excised and sent for microscopic examination. It showed typical structure of a rhinosporidial granuloma (figures 5 and 6).

The patient was further investigated to see if there was any primary growth in the nose or nasopharynx. No lesion could be discovered.

*Investigations.*—His blood was taken for Kahn reaction and was found to be positive + + + +. The cytological examination of the blood showed the following picture:—

Red blood corpuscles	..	4,400,000 per c.mm.
Hæmoglobin	..	69.55 per cent.
Colour index	..	0.87
White blood corpuscles	..	13,000 per c.mm.
Polymorphonuclears—		
Neutrophiles	..	65 per cent.
Eosinophiles	..	13
Basophiles	..	Nil.
Mononuclears—		
Large mononuclears	..	1 per cent.
Lymphocytes	..	21 "

In order to find out whether spores or sporangia were present in the circulation, on two occasions 10 c.cm. of blood of the patient was taken and laked with distilled water. It was then centrifugalized and the deposit was carefully examined for spores or sporangia. The result on both occasions was negative. A blood culture was not attempted because there was no satisfactory method available for growing the organisms from blood; indeed it is a question whether the organism has been cultivated.

*Cultivation and inoculation.*—As a large amount of material free from any contaminating microbe was available one of the nodules



was cut out aseptically and the material was emulsified and planted on all the routine media employed in the laboratory, i.e., (1) nutrient agar, (2) blood agar, (3) ascitic agar, (4) Endo's medium, (5) Löwenstein's medium, (6) Sabouraud's medium, (7) Löffler's serum medium, (8) glucose broth, and (9) potato-water medium. The cultures were grown aerobically and anaerobically at 37°C. and at room temperature, and were observed for nearly three months before they were discarded. In Löwenstein's and potato-water medium the organisms were seen in a well-preserved state for over two months, but at no time during the fortnightly examinations was there any evidence of the growth of the fungus. The attempt at cultivation was thus disappointing. So also was an effort to transplant the growth into the subcutaneous tissues of guinea-pigs and dogs. Three guinea-pigs and two dogs were used. Sections cut out from sites where bits of tissue were planted after a period of about two months showed only degenerating sporangia and a chronic inflammatory reaction which appeared to have successfully encapsulated the material. There was no evidence of invasion on the part of the parasite into the surrounding tissue. In one guinea-pig a few apparently healthy-looking sporangia were seen in a biopsy taken from the site of implantation after about a month. The animal was further observed and the mass progressively diminished in size until ultimately nothing could be felt at the site of injection except a small scar of the biopsy.

#### Comment

A case of rhinosporidial infection in connection with the penis has been described by Ingram (1910). In his case there was a cauliflower-like growth which covered the whole of the glans penis which was enlarged to the size of a baby's fist. The external urinary meatus and probably the contiguous portion of the urethral mucous membrane was involved. In the case described the growth originated a little way up in the urethra and formed polypoid masses which protruded from the urethral opening. Karunaratne (1939) has given a summary of 104 cases studied by him and a synopsis of 280 human cases recorded up to 1939 and apart from the case described by Ingram there is no other report of an infection in connection with the penis. Kurup (1931) mentions that Mohammedans are especially liable to rhinosporidial infection. In this particular case the patient happens to be a Mohammedan, but in my series of 45 cases the Hindus and the Mohammedans are more or less equally affected.

The second case appears to be unique. In the synopsis by Karunaratne referred to above, there is no record of a case of a generalized infection as was seen in this case. In a previous article Karunaratne (1936) makes a statement that the infection remains localized to the

original site though nearby sites may become infected but there is no evidence of generalized hæmatogenous dissemination. In this case a few swellings had ulcerated on the surface and a few areas in the contiguous portion did show the presence of a fungus which might be ascribed to contact infection. But a large number of swellings scattered on the legs, thorax, abdomen, back and the superior extremities could not possibly be accounted for by a contact infection. Besides many of the large swellings had an intact skin covering them. Lymphatic spread cannot explain such a wide anatomical distribution. The only process by which such a generalized dissemination could be explained is by the hæmatogenous route. The failure to demonstrate the fungus in the blood by microscopic examination does not militate against the possibility of hæmatogenous spread, for it is well known that a cultural examination becomes necessary to demonstrate micro-organisms in septicæmic conditions, unless the infection is very massive. Unfortunately a suitable method of cultivation of the parasite has yet to be described. Except for a single reference quoted below there has been no record of a successful culture of the fungus.

Even when such rich material was available for the cultivation of the fungus, all attempts to grow them have failed. Tirumurti (1914) attempted unsuccessfully to cultivate the organism and to produce infection in animals. Duggan (Karunaratne, 1939) mentions that successful growth of the organisms was obtained by Iyer on Sabouraud's medium. In my experiments Sabouraud's medium was employed, but I have failed to obtain a growth. The organisms were seen in a state of relatively good preservation for some time, but the best medium from that point of view in my experience was potato-water medium. The positive Kahn reaction appears to be accidental. It might be of interest to add that the patient was given large doses of potassium iodide for a period of three weeks but the swellings were not in any way affected by the treatment.

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#### EXPLANATION OF PLATE XXVII

- Fig. 1. Case 1.—A photograph of the growth as it was seen protruding from the urethra.
- Fig. 2. Case 1.—Same after pressure to show larger portion protruding.
- Fig. 3. Case 2.—A front-view photograph of a patient to show the multiple growths some ulcerating and others covered with intact skin. The bandage on the right arm shows the areas from which a swelling was cut out for histological examination.
- Fig. 4. Case 2.—Hind view photograph of the same patient. See the large swellings on the left arm and forearm.
- Fig. 5. Photomicrograph. A low power view to show the intact skin and the well circumscribed nature of the rhinosporidial mass.
- Fig. 6. Photomicrograph. A high power picture to show the typical structure of the spores and sporangia.



Fig. 1. *Case 1.*



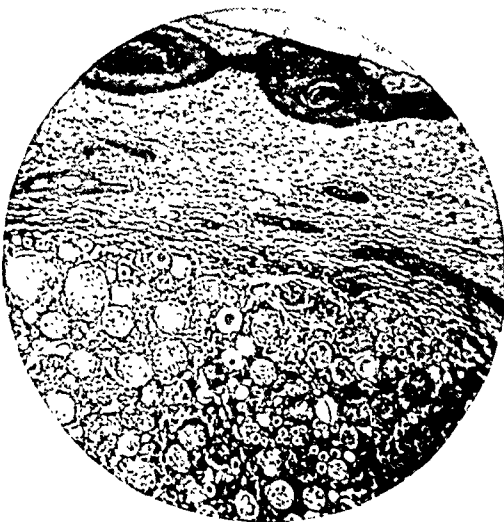
Fig. 2. *Case 1.*



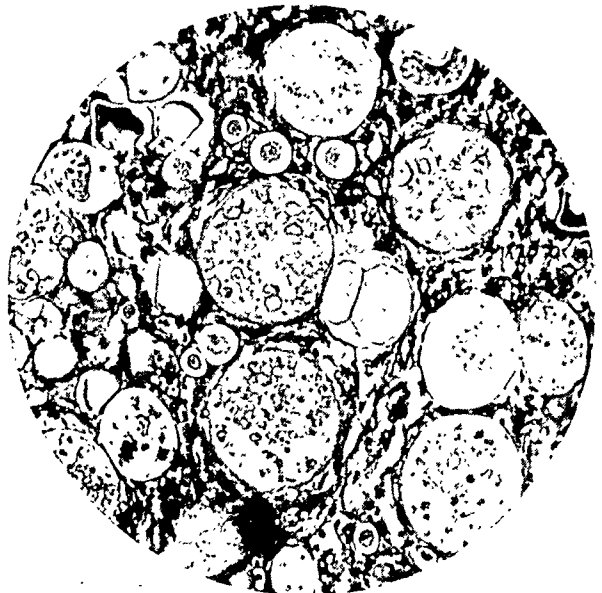
Fig. 3. *Case 2.*



Fig. 4. *Case 2.*



200μ  
Fig. 5



50μ

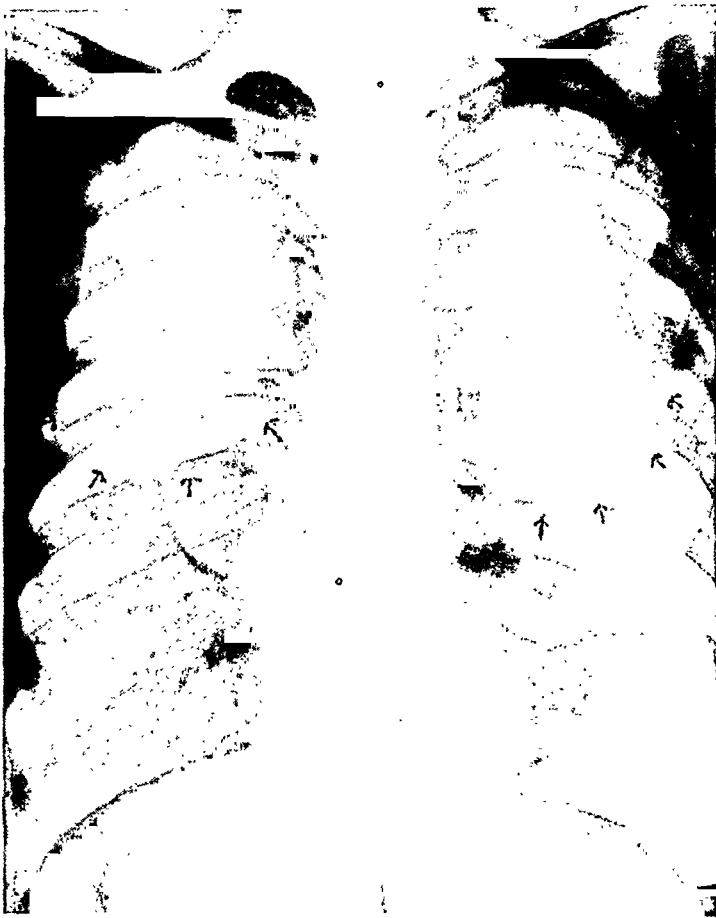


Fig. 1. Case 2.—Showing two big bullæ at both the apices. The outline is shown by arrows.



Fig. 2. Case 2.—The same injected with lipiodol. The lipiodol does not enter into the bullæ.



Fig. 3. Case 3.—Showing big bullæ of the right side.

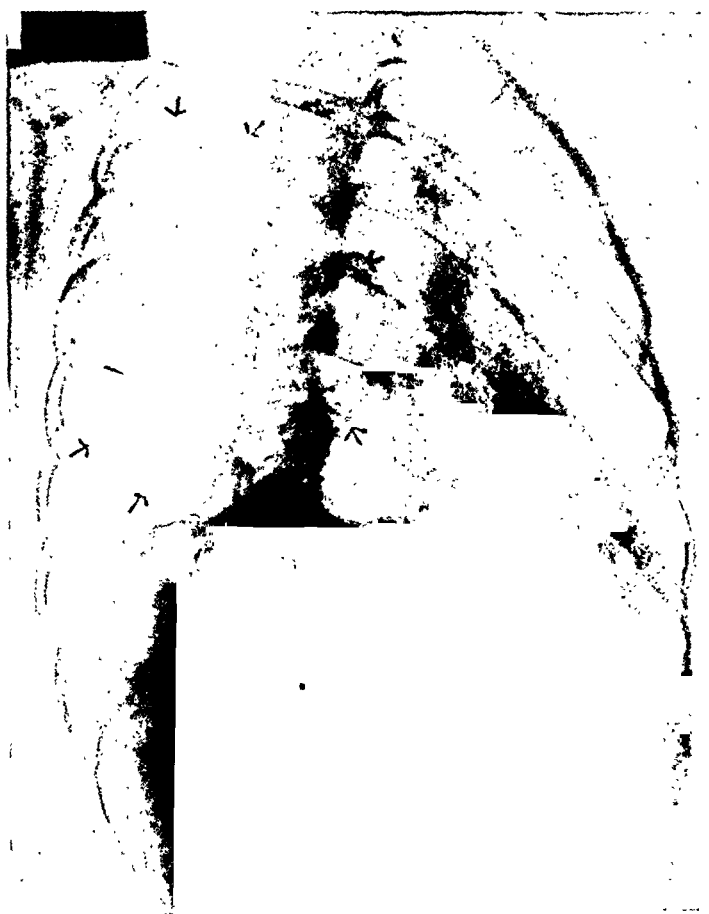


Fig. 4. Case 3.—The same as figure 3 right oblique view. The outline is shown by arrows.

## BULLOUS EMPHYSEMA OF THE LUNG

By T. K. RAMAN, M.D., D.T.M. (Cal.)

(From the Department of Medicine, Andhra Medical College, Vizagapatam)

ALTHOUGH emphysema of the lung has been described by Lannaec the condition of bullous emphysema has come into prominence only recently. Kerley (1931) reported a case with two large bullæ, one at the left apex and the other at the right base. The clinical findings suggested spontaneous pneumothorax and the radiological diagnosis of bullous emphysema was confirmed post mortem. Kerley (1936) described bullous emphysema as a clinical entity. Wiese *et al.* (1939) described a case of multiple bullous emphysema in a male aged 38 years. Radiological appearance suggested bullæ on either side. Twenty large and small emphysematous bullæ were seen post mortem. The condition was associated with anthracosilicosis, and was under observation for several years. Illingworth (1938) reported a case of congenital emphysematous bullæ (air-containing cyst) at the base of the right lung in a girl aged 1 year and 3 months. Paracentesis showed positive pressure and 100 and 76 c.cm. of air was withdrawn on two successive days. The patient was discharged and subsequent examination showed the same signs without any improvement. The condition is extremely rare and the literature on bullous emphysema during the last four years contains only a few papers. Description of four cases met with in Vizagapatam are given below.

*Case 1.*—Hindu male, aged 34 years, cloth merchant, was admitted on 8th August, 1936, with a history of fever and dyspnoea of seven years' duration. He gave a history of breathlessness 16 years back, an attack of hæmoptysis eight years ago and frequent attacks of dyspnoea for the last four years. He had an attack of gonorrhœa but denied any history of syphilis.

(Continued from previous page)

## Summary

1. Two unusual cases, one of rhinosporidial infection of the penis and the other a generalized infection, are described.
2. The spread in the latter case must have been hæmatogenous.
3. Attempts at cultivation and inoculation into animals were unsuccessful.

*Acknowledgments.*—For the clinical notes of the first case my thanks are due to Dr. R. N. Cooper, Honorary Surgeon, King Edward VII Memorial Hospital, Bombay.

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Physical examination showed a moderately nourished individual with slight œdema of the legs and a condition of dyspnoea.

Respiratory system: chest barrel-shaped, movements equal on both sides but diminished, markedly hyper-resonant note all over, vocal fremitus and resonance slightly increased on both bases, respirations prolonged and rhonchi were heard on both sides.

X-ray of chest showed two emphysematous bullæ, a big one at the apex of the left side and a small one in the middle of the right side.

Circulatory system: cyanosis of the lips, prominent jugular veins, blood pressure 90/68, and radial arteries slightly thickened. Heart boundaries could not be made out on account of hyper-resonance. Heart sounds normal but feeble. Liver palpable three fingers below the costal margin. Blood showed eosinophilia.

Sputum negative for tubercle bacilli.

The patient was running a temperature between 99°F. to 100°F. He was transferred to the tuberculosis department on 18th August, 1936. An exploratory puncture caused extreme dyspnoea and the patient died a few hours later, probably as a result of spontaneous pneumothorax by a rupture of emphysematous bullæ.

*Case 2.*—Hindu male, compounder, aged 37 years, was admitted on 23rd February, 1939, with a history of cough and breathlessness of ten months' duration. He gave a history of dysentery for ten years and cough and heaviness in the chest of nine months' duration. Treatment gave no relief and dyspnoea was marked for the last four months, especially after exertion. His father died in 1913 with chronic lung disease.

Physical examination: a poorly nourished individual with slight clubbing of fingers and slight œdema of the legs.

Respiratory system: respirations 20 per minute, laboured, chest symmetrical but expansion diminished. Vocal fremitus and vocal resonance normal at both bases. Percussion note slightly hyper-resonant at both apices; a few crepitations were heard on both sides.

Circulatory system: blood pressure 94/60, heart sounds normal but feeble.

Liver palpable three fingers breadth below costal margin, spleen not palpable.

Urine: trace of sugar present.

Blood: hæmoglobin 70 per cent, red blood corpuscles 3.9 millions, polymorphonuclears 86 per cent, lymphocytes 8 per cent, eosinophils 4 per cent and mononuclears 2 per cent, anisocytosis, poikilocytosis and a picture of microcytic anaemia. Ancylostome ova in the stools. Sputum—no tubercle bacilli.

X-ray of the chest (figure 1) showed two big bullæ at both the apices. A second x-ray with lipiodol (figure 2) showed that lipiodol did not enter these bullæ.

The patient was discharged on 20th March, 1939. He was re-admitted on 16th June, 1939, with the same symptoms but more severe. Blood pressure 115/90. No further investigation was possible and he was discharged on 20th June, 1939.

*Case 3.*—Hindu male, aged 25 years, was admitted on 3rd May, 1941, with a history of cough, hæmoptysis and slight dyspnoea of six months' duration. He had had recurrent attacks of bronchitis for the last three years and occasional hæmoptysis.

Physical examination showed a fairly well-nourished individual with slight anaemia.

Respiratory system showed diminished movements of the chest, vocal fremitus and vocal resonance present on both sides. Percussion note hyper-resonant on the right side in front and behind, breath sounds were completely absent over the right side, in front and back. X-ray showed bullous emphysema of the right side (figures 3 and 4).

Circulatory system: normal.

He was running a low temperature between 99°F. to 100°F. while in hospital.

Urine: normal. Blood: hæmoglobin 80 per cent, red blood corpuscles 3.9 millions, leucocytes 9,000. Repeated examination of sputum did not reveal tubercle bacilli.

He was discharged on 15th May, 1941.

Case 4.—Hindu male, was admitted on 5th June, 1941, with a history of breathlessness on exertion, cough and expectoration of one year's duration. He gave a history of syphilis 20 years ago.

Physical examination showed an ill-nourished individual with slight prominent eyes and slight clubbing of fingers.

Respiratory system: patient in a condition of dyspnoea, expansion of the chest diminished, vocal fremitus and resonance diminished at both apices more at the left apex, percussion showed hyper-resonant note all over, auscultation showed feeble breath sounds at both apices more marked on the left side. Occasional wheezing expiratory sounds were heard.

X-ray showed multiple giant bullae at both apices.

Circulatory system: apex beat in the 6th interspace just external to the nipple line, systolic and diastolic murmurs were heard in the mitral, aortic and pulmonary areas, blood pressure 105/40. Blood: red blood corpuscles 4.24 millions, leucocytes 9,800, polymorphonuclears 64 per cent, lymphocytes 15 per cent, mononuclears 13 per cent, eosinophils 10 per cent.

Sputum negative for tubercle bacilli. The case is one of multiple bullous emphysema in a patient who has got aortic regurgitation. The multiple giant bullae might be the result of syphilitic fibrosis of the lung. No further investigation was possible since he refused to remain in the hospital.

### Discussion

What exactly bullous emphysema is, is not definitely known. Some are of opinion that the condition is due to a developmental defect and is congenital in origin. Kerley thinks that in the case he described syphilitic fibrosis of the lung was responsible for the formation of large emphysematous bullae. Fibrosis causes stenosis of the bronchi which leads to the formation of large bullae. Other forms of fibrosis such as tuberculosis and anthracosilicosis can produce the same condition.

Of the four cases reported here the first case was diagnosed as double pneumothorax and the introduction of a needle into the large bullae caused death by the production of spontaneous pneumothorax; in the second case diagnosis was made by radiological appearances; in the third the condition was diagnosed clinically by the slight hyper-resonant note and absence of breath sounds on the right side. The question arose whether it was a case of localized spontaneous pneumothorax or bullous emphysema of the right side. Clinical diagnosis was confirmed by radiological observations. The patient had to be discharged and he could not be followed further. In the fourth case the patient had extreme dyspnoea out of proportion to the physical signs. A clinical diagnosis of bullous emphysema was provisionally made; the diagnosis was confirmed radiologically and multiple giant bullae were seen on both sides. In the second case lipiodol injected into the trachea did not enter these bullae.

Differential diagnosis arises between localized pneumothorax, congenital cystic disease, and big cavities in the lung.

Positive diagnosis can be made only by x-rays and when the definite outlines of the bullae are

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## PANCREATIC CALCULI

By MANGALDAS J. SHAH, M.B., B.S. (Bom.),  
M.R.C.P. (Lond.), D.T.M. & H. (Lond.)

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Bombay, Honorary Physician to Sir Harkisondas  
Hospital, Bombay

CASES of pancreatic lithiasis are rare; this is evident from the fact that so far less than 150 cases have been reported in the literature. To my knowledge only one case has been reported in India, i.e., by Kini (1938). Prior to the advent of x-rays, the case reports came only from the post-mortem rooms. Pancreatic lithiasis was first detected and described by de Graf in 1667. Cawley in 1788 detected pancreatic calculi post mortem in a man, who was a known subject of diabetes during his life time. Thus, Cawley was the first to associate diabetes with pancreatic calculi. Oser in 1903 collected and reviewed 70 cases of pancreatic lithiasis of which 24 cases were suffering from glycosuria during life. In 1904 Robson suggested the use of x-rays for the diagnosis of the condition during life, because of the high calcium content of the calculi. In 1912 Assmann reported a case in which radiological diagnosis was made during life and was confirmed post mortem. In 1928 Seeger reviewed a total of 101 cases including one case of his own; and in 1932 Ackman and Ross reviewed 108 cases. In 1936 Dr. J. G. Mayo reported 25 cases from the records of Mayo Clinic out of which the diagnosis was correctly made prior to operation in 2 cases; diagnosis was incidental in 14 cases during some other abdominal operation; and it was made post mortem in 9 cases. In India, Kini reported a case of

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seen the diagnosis is easy but when indefinite only post mortem will settle the diagnosis.

### Summary

Four cases of bullous emphysema are described. In the first case the diagnosis was missed, in the second diagnosis was made by the radiological appearances, and in the third and fourth cases the diagnosis was made clinically and confirmed by x-rays.

### Acknowledgments

My thanks are due to Dr. P. Kutumbiah, for the clinical notes and to Dr. P. Kesavaswamy and Dr. C. Benjamin, for the x-ray plates.

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Fig. 1. Case 1.

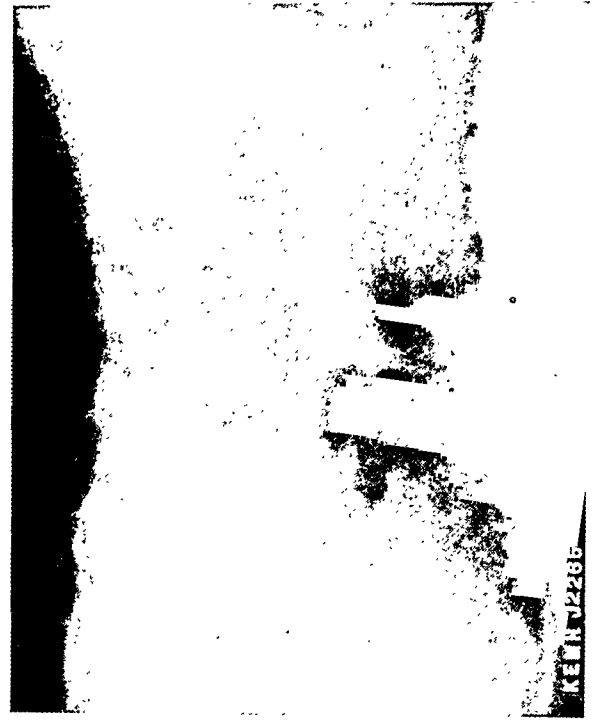


Fig. 2. Case 1.



Fig. 3. Case 2.



Fig. 4. Case 2.





multiple pancreatic calculi associated with chronic pancreatitis in 1937. A few cases of successful surgical treatment are recorded.

Herewith 2 cases are reported, one detected at the K. E. M. Hospital and another at Sir Harkisondas Hospital, Bombay.

**Case 1.**—A male patient, aged 28 years, sought admission to the K. E. M. Hospital on 15th April, 1940, for attacks of colicky pain over the lower part of epigastrium and for symptoms of frequency of micturition, polydipsia, excessive hunger, and loss of weight (50 lb. in 2 years). The pain was described as colicky, severe, shooting across the lower part of epigastrium from right to left, lasting from a few minutes to an hour or more and bearing no relation to food, defaecation or other factors. The total duration of pain was six months. The other symptoms had become marked during last six months.

There was no history of any previous illness, and there was nothing of importance in the personal and family history.

On general examination, the patient appeared markedly depressed, emaciated and asthenic. There was slight diffuse tenderness in the epigastric area. The other systems showed no abnormal findings.

The other investigations were as follows:—

**X-ray.**—A plain radiogram showed a chain of dense shadows going obliquely across at the level of the lower border of the body of the 12th dorsal and the 1st lumbar vertebrae, extending for about one inch on the right side over the body and for about 2 inches towards the left side (plate XXIX, figures 1 and 2).

**Stools.**—Loose, large, whitish and showed the presence of fat globules under the microscope.

Fat analysis showed the following:—

Total fat	..	..	36 per cent.
Unsoaped fat	..	..	12 " "
Neutral fat	..	..	4 " "
Free fatty acids	..	..	7 " "
Combined fatty acids	..	..	13 " "

**Urine.**—Showed presence of marked glycosuria, and ketone bodies.

**Blood sugar.**—The glucose tolerance test was as follows:—

Fasting sugar	..	..	250 mg.
$\frac{1}{2}$ hour after glucose	..	..	363.6 "
1 " " "	..	..	333.6 "
$1\frac{1}{2}$ hours " "	..	..	307.6 "
2 " " "	..	..	285.7 "

After a stay of about a week in the hospital the patient went away against advice. He was reported to have died at his residence about a month after leaving the hospital.

**Case 2.**—A male, aged 44 years, admitted on 16th July, 1940. He complained of abdominal pain in the left half of the umbilical area, loss of weight (20 lb. in 6 months), and of passing oily stools for about seven months. The trouble started with an acute attack of severe colicky pain in the above region shooting towards the back on the left side seven months previously, the attack lasting for four days. He had a second severe attack a month later and a third four days before admission. There was no nausea or vomiting during the attack. He also had a continuous dull aching pain, not related to food or other factors, in the same area, since his first attack. The oily stools were particularly marked after taking a diet rich in fats (ghee). The loss of weight was gradual.

He gave a history of having suffered from dysentery and jaundice ten years ago. There was nothing of importance in personal or family history.

On physical examination, the patient was pale, emaciated and markedly asthenic. There was slight tenderness in the region of pain in abdomen.

The following is a short account of the investigations:—

- X-ray.**—(a) Plain x-ray in antero-posterior view shows a chain of dense curved shadows, crossing the front of the vertebral column at the 12th dorsal vertebra, extending for about 2 inches on either side, and the lower ends of the curves reaching to the level of first lumbar (figure 3).  
(b) In the lateral view the greater part of the shadows lies in front of the vertebra while a few shadows seem to superimpose on the vertebral shadow (figure 4).  
(c) Cholecystograms were normal.  
(d) Descending pyelography with uroselectan B injected intravenously was done and the urinary tracts were found normal.

**Stools.**—The stools were large, slightly whitish, foul-smelling, and showed plenty of fat globules under the microscope.

The fat analysis showed the following:—

Total fats	..	..	48 per cent.
Neutral fats	..	..	27 " "
Free fatty acids	..	..	10 " "
Combined fatty acids	..	..	11 " "

**Urine.**—Showed the presence of sugar up to 5 per cent but no ketone bodies. There were no abnormal microscopic findings.

**Blood sugar.**—The glucose tolerance test showed—

Fasting level	..	..	140 mg.
$\frac{1}{2}$ hour after glucose	..	..	160 "
1 " " "	..	..	160 "
$1\frac{1}{2}$ hours " "	..	..	170 "
2 " " "	..	..	160 "

**Enzyme studies.**—

(a) Urine diastase index	..	..	6.7 per cent.
(b) Blood diastase index	..	..	4.2 " "

The blood count showed a moderate degree of anaemia.

The fact that one was able to detect 2 cases of pancreatic lithiasis in a short course of three months can be accounted as pure chance. It will not be out of place to quote Korte's remarks that disease of the pancreas would be far commoner if the doctor would only remember that his patient had a pancreas.

### *Ætiology and pathology*

The exact ætiology of pancreatic calculi is not determined with certainty. It seems to be more frequent in males, since 75 per cent of the reported cases are males. Both the present reported cases are males. Stasis of the pancreatic secretion alone cannot be a causative factor, because the normal pancreatic secretion does not contain calcium carbonate. Also the experimental tying of the main pancreatic duct in animals does not result in stone formation. Infection of the pancreas, through the duct, the lymphatics or the blood, would alter the pancreatic secretion and might lead to formation of calcium stone. Primary pancreatic infection with secondary stasis of the altered secretion seems to be the cause. Biliary disease, e.g., cholecystitis, gall stones, etc., which is associated in many cases might possibly be the source of infection in those cases.

No apparent cause could be found in the first case, while the history of the dysentery and jaundice might be causative in the second case.

Mayo describes two types of pancreatic stones. Those within the ducts are true stones. The false stones are due to calcification of the parenchymatous tissue of the pancreas. The number of stones vary from a single calculus to multiple calculi. The size may be anything from that of a minute sand-grain to one as large as 2 inches in diameter. The shape may be irregular, or faceted. They are pale yellow to light grey in colour. They are very friable—a point of importance for surgical treatment. The main constituent in their composition is calcium carbonate and calcium phosphate.

The effects of the calculi on the pancreas may be *nil*, or they may lead to fatty degeneration, fibrosis, cyst formation, or abscess formation. Usually it is the acinous tissue that perishes first and then the islets of Langerhans. In both the reported cases the calculi are multiple. Both of them showed evidence of affection of both the external and the internal secretions of the pancreas as shown by steatorrhœa, and glycosuria. Steatorrhœa was more marked in the second case, while hyperglycæmia was more evident in the first case.

*Symptoms.*—There are no symptoms that can be said to be typical of pancreatic lithiasis. The symptoms are mainly of four groups, *viz.*, those due to intermittent obstruction of the pancreatic duct, those due to disorganization and destruction of the pancreas, those due to interference with the bile duct, and finally those of the associated disease.

*Pain.*—Pain is perhaps the commonest symptom. The situation of pain varies from case to case. It may be in epigastric, umbilical, right hypochondriac, left hypochondriac or in lumbar areas. In the present series the pain was situated over the lower part of epigastrium in the first case and over the left half of the umbilical area in the second case. Its character may be dull and continuous or colicky and intermittent. The pain was colicky in the first case, while it was both colicky and dull aching in the second case. Ackman and Ross report colicky epigastric pain in 19 out of 29 cases. The pain may radiate to the back, shoulders, scapulæ, lumbar area, or iliac fossa, depending on the position of the affected pancreatic area. The pain in the first case radiated across the lower epigastrium from right to left and it radiated to the back in the second case. Nausea and vomiting are frequently present during the acute paroxysms; they were absent in both my cases.

*Steatorrhœa and diarrhœa.*—The stools are usually oily, large whitish-coloured, frothy, foul-smelling and contain grossly indigested food. The diarrhœa may increase during the attacks of pain. Microscopic and chemical examinations of the stools show the presence of excess of unsplit fat, and partially digested muscle fibres in meat eaters. Very rarely small stones may be detected in the stools. Both the cases showed

increased fat content in their stools, more so the second case.

*Glycosuria and hyperglycæmia.*—Oser reported association of glycosuria and pancreatic lithiasis in 24 out of 70 cases. Opie (1910) stated that glycosuria came late in the course of the disease when fibrosis and disorganization of the pancreas had become extensive. The first case showed both glycosuria and hyperglycæmia. In the second case, there was glycosuria and the fasting blood sugar level was definitely raised, but the blood sugar curve was a flat one. This might be attributed to lack of proper intestinal absorption of glucose and the appearance of sugar in urine at blood-sugar level of 160 mg. could be explained as due to lowering of the renal threshold for sugar.

*Jaundice.*—Obstructive jaundice has been reported in 25 per cent of cases, which might be due to obstruction at the ampulla of Vater by the calculus, or pressure on the common bile duct by stones or by inflammatory swelling in the head of the pancreas. In neither of my cases was there jaundice.

*Loss of weight.*—There is usually a marked loss of weight and asthenia in these cases. In the first case there was a loss of 50 pounds in 2 years. The second patient lost 20 pounds in 6 months.

*Physical signs.*—There are no physical signs peculiar to the disease. Consequently diagnosis of pancreatic calculi cannot be made on any one physical sign. Both the cases showed only vague tenderness over the areas of pain in the abdomen.

*Investigations.*—X-ray. As previously stated Mayo Robson was the first to draw attention to the importance of x-rays in making the diagnosis. It is still the best method of making a pre-operative diagnosis of pancreatic calculi. In all cases of pain in the upper abdomen, a plain radiogram without a barium meal is very necessary, since the presence of an opaque meal in the stomach completely or partially obscures the pancreatic site. In a few cases the calculi may be too minute or may contain too little calcium to cast a shadow. A summary of the study from copies of radiograms in 30 cases by Gillies (1939) is given below :—

- (a) *Location*—In 21 cases the shadows were situated in an area below a plane drawn at the upper margin of the first lumbar and above a plane at the lower margin of the third lumbar vertebra. In 9 cases the stones were above the upper plane, but in no case were they below the lower plane.
- (b) *Size*—The size of the shadows varied from that of sand-grains to about 2 inches in diameter.
- (c) *Density*—The shadows were so very dense that they were visible even in front of the vertebral shadows.
- (d) *Number and shape*—Multiple calculi were the commonest, being present in 24 out of 30 cases. The shape was irregular in the majority. The contour of the pancreas was outlined with the calculi in the head being on the right of the spine while those in the neck, body and tail extended across the middle line to the left.

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# PRACTICAL ASPECTS ON GENERAL ANASARCA, ESPECIALLY IN MALARIAL NEPHRITIS AND HOOKWORM DISEASE\*

By ROBERT HEILIG, M.D.

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THERE are certain periods of the year when Krishnarajendra Hospital cannot provide enough beds for ascites-anasarca cases asking for admission; this periodicity of maximal oedema collection seems to be a problem in itself though

\* Read at the XIIIth Annual Conference, Mysore Medical Association.

(Continued from previous page)

The radiograms in both the reported cases are slightly higher, but reach at some points the upper plane of the first lumbar vertebra. Also the contour, shape, density of the shadows together with the symptoms, steatorrhoea and glycosuria, leave no doubt regarding the diagnosis. In the second case care was taken to rule out stones in the gall bladder or kidneys.

The radiograms suggestive of pancreatic calculi have to be differentiated from calcified glands, gall-bladder stones and renal calculi.

Special enzyme studies to show an acute diminution of pancreatic enzymes in the stools, and in material obtained on passing a duodenal tube, and an increase in urinary and blood diastase index may be undertaken.

## Summary

1. Two cases of pancreatic lithiasis diagnosed during life are reported.

2. The ætiology, pathology, symptoms and signs, and radiological findings are discussed.

*Acknowledgment.*—I wish to thank the Dean of the K. E. M. Hospital, Dr. Jivraj N. Mehta, and my chief, Dr. P. C. Bharucha, for permitting me to report the first case. I also thank my other colleagues for helping me in my investigation of both the cases.

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many non-medical reasons, such as variations in the intensity and urgency of agricultural work, may be of importance. Most of our anasarca cases belong to one of the three groups :—

- (a) Heart-failure.
- (b) Nephritis.
- (c) Ancylostomiasis.

(a) *Heart-failure.*—The group is the best known and thus the least interesting, here presenting not many differences from heart-failure cases anywhere else. The heart-failure that causes water retention in our patients is either due to a valvular disease or a consequence of essential hypertension; the group of heart muscle degeneration without hypertension, due to atherosclerotic or syphilitic changes especially of the coronary vessels, is in our experience rather rare, whereas it constitutes an overwhelming majority among failing hearts in Europe. To save space for the more detailed description of both the other groups we refrain from discussing our experiences in heart-failure on this occasion.

(b) *Nephritis.*—General anasarca due to kidney disease is seen here sometimes in acute glomerulo-nephritis, sometimes in acute exacerbation of chronic glomerulo-nephritis, but mostly as a wet or nephrotic type of subacute glomerulo-nephritis. In fact, we see about four times more subacute than acute or chronic manifestations of glomerulo-nephritis. During the last 8 months we have admitted 6 cases of acute glomerulo-nephritis; oliguria with high specific gravity, albuminuria, blood and casts in the urine, moderately increased blood pressure, moderately enlarged heart, normal or moderately increased blood urea, absence of fundal changes and the very characteristic distribution of the abundant oedema that started on the eyelids, nearly closing them, and on the face a few days before admission, exclude every other diagnostic possibility. But it is remarkable that 4 of these cases—young girls all of them—suffered from acute malaria, 2 benign, 2 malignant tertian, with regular attack of rigor and fever up to 20 days previous to the appearance of oedema, and along with the acute nephritis. The ætiological importance of the malarial infection for the development of an acute nephritis seems to be made very probable by the fact that all these 4 cases responded excellently to routine quinine treatment, by losing oedema, albuminuria, and hæmaturia in an average of 16 days, a time sufficient to reduce the pressure from 150, 145, 130 and 130, respectively, to normal and to make disappear the enlargement of the heart in the 3 cases where it was present; I have never seen such rapid healing in fully-developed cases of non-malarial origin; in fact the 2 cases where no sign of malaria could be detected left the hospital after 2 and 3 months, respectively, with albumin and red cells still present, most probably developing lasting kidney damage.

the class or school prizes can be given to the children with the largest number of golden discs earned during the year. Punctuality can be included in the items and it should be remembered that strict punctuality on the part of the teacher is an important requirement.

Care of personal belongings, apparatus and books handled in the school can also be scored in the same way or separately. The children should be taught to maintain their own diaries and to make the entries honestly. This may be said to be the *personal aspect* of health participation.

With regard to the *community aspect*, the task for the teacher is not more easy. This entails developing a correct attitude by the children towards each other's property, books and clothing. The practice of sucking pencils and exchanging clothing, utensils, mugs, etc., is strictly discouraged. Spitting is forbidden and careful wash-room and latrine drill is carried out. The children are themselves made responsible for the proper disposal of paper and refuse in the play-ground and class-room.

As regards the part played by the teacher directly in the community aspect of practice teaching: A daily collection of drinking water should be made, the water being stored in the sun in *chatties* or other receptacles after boiling or disinfecting. The teacher must be responsible for this work, but later it can be left to the children so that no water is drunk by the members of the class other than that prepared for the purpose. The teacher must see that the children wash their hands before drinking or that the children use their individual mugs properly rinsed. The teacher must also be responsible for a daily inspection of wash-rooms and latrines.

If food is eaten in the school, it is very useful if the teacher can keep a small depository where all the food is stored in a cool place, free from flies and dust. She must then supervise the washing of hands before eating, and the disposal of papers and refuse. Later on this responsibility can be made over to the older children so that there is built up a community feeling. In order to prevent flies from collecting in the class-room small dishes of mud containing formalin, sugar and water can be placed in corners or near the food store to entrap flies and insects.

With regard to the lighting and airing of class-rooms, the teacher can train the children to regulate ventilation and light for themselves by airing the room between classes and by opening and shutting windows to avoid overheating and glare. The tidiness of the class-room can also be the responsibility of the pupils under the supervision of the teacher.

In this way the home conditions are to some extent duplicated and the child functions as a unit in a community while the teacher to some extent represents the health authorities.

It is not possible, of course, to neglect instruction or definite lessons in hygiene. Textbooks have to be relied upon. But if we take one of the subjects dealt with in the book, for example water supply, we can see how the textbook instructions can be supplemented by practical lessons in the school and outside.

In the case of water, for instance, one has already mentioned the supervision of the drinking water for the class. In Ceylon, water is boiled and then stored in a cheap galvanized iron can fitted with a tap. The children collect and boil the water every evening before school closes and fill the container so that the water chills overnight for use next morning. Rough earthenware cups and *chatties* can be used to replace more expensive apparatus. Secondly, in the class demonstrations can be given on the effect of adding alum, chlorine, etc., to water. Thirdly, the children can be taken out to inspect the local wells or water supply and a discussion on wastage of water can be held. In towns it is possible to visit the water works and museums where models are shown.

A simple talk on the contamination of water and the diseases which are spread by infected water can be given. This might be a professional talk arranged through the co-operation of the local doctor. Finally, a discussion on the precautions taken to protect water and the water supply in the school can be held. All subjects can be treated in a similar way, supplementing the lessons and practice in the class by utilizing facilities in the community and in the neighbourhood.

There are two further approaches to community health teaching of children, useful both for the teacher and the pupil. The first of these is the holding of safety-first exercises and first-aid drill. Many schools can, and do, develop these schemes on simple lines. The second is school medical inspection.

The school medical inspection is often regarded by the teacher as a time-consuming interruption of little apparent use. But school medical inspection offers three essential contributions to the teaching of civic health:

(1) It provides an opportunity for the teacher to have the doctor's opinion on children whom she suspects need special medical care or dieting or who are a source of infection to the other pupils.

(2) It provides an opportunity to make contact with the parents. School medical inspection can only be of value to the community if the parent is present at the inspection along with the teacher. One may here cite an instance of how often confusion arises with regard to the purposes of school medical inspection. Looking over medical inspection cards in a school for middle class boys in Calcutta, one found against the caption 'Parents present?' 'Yes' was invariably

(Concluded on opposite page)

## A NEW AND HIGHLY POTENT TYPHOID VACCINE : A REVIEW

By K. V. KRISHNAN, M.B., B.S., M.R.C.P., D.B., D.Sc.  
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AMONG the prophylactic vaccines commonly employed in public health work, typhoid vaccine occupies a place of great importance. In this country, the vaccine is prepared not only by government laboratories, but also by several commercial firms. The results obtained by the use of these vaccines have not been always uniformly good. Complaints have been received from time to time of severe outbreaks of typhoid among recently immunized families and communities, and doubts have been raised as to the protective properties of the vaccine employed. From enquiries into the nature of the vaccines used and their method of preparation, and from the actual testing of some of these vaccines and of the strains of typhoid bacillus used in their manufacture, we are led to believe that some of the manufacturers of these vaccines in this country are not aware of the recent advances in our knowledge of anti-typhoid immunization, and that they are still following the methods of vaccine preparation. This article is specially

(Continued from previous page)

written. Yet at the time of the inspection then being held not a single parent was in attendance. On enquiry it became clear that the teachers were under the impression that the phrase 'parents present' meant 'are the parents alive?'! The interest of the teacher therefore is essential to successful inspection.

(3) The teacher is given an opportunity to talk over with the medical officer some of her problems which may have a medical basis, for example, Atul, who is short-sighted, or Monesh who seems inattentive, but whom the doctor finds is slightly deaf. Aruna who cannot concentrate but is found by the doctor to have worms. Interest for the teacher in her class widens and deepens with such a programme of health education, and each child's home conditions begin to have a meaning.

In small rural schools contact with the parents is easier, but bad transportation and poor communications often interfere with regular attendance and the malaria season in such schools is only too often clearly marked by a great fall in attendance. It is difficult to keep up a sustained programme of health education under such circumstances.

The field of the teacher in health education is largely dependent on the ingenuity, interest and knowledge which she can place at the service of her pupils. The inception of compulsory primary education, however, opens up for us a new era as regards the development of health education in schools.

written with the object of placing the newer knowledge in the hands of interested persons, so that they may prepare or direct the preparation of the new type of vaccine, which recent work has established to be superior in its protective property to the old vaccine. Within the last few years a very large number of valuable contributions pertaining to the subject have been made by different workers (Felix, Perry, Grinnell, Rainsford, Kauffmann and Benstead) and in the March (1941) issue of the *British Medical Journal* a review of the practical advances made is presented (Felix, 1941). This article is only a brief summary of the latest findings and recommendations contained in these publications.

The original method of making typhoid vaccine, as is well known, is that of Kolle, Wright and others, and consists in making a saline suspension of typhoid bacillus (Rawling's strain) grown on meat infusion agar, killing the organisms by heat at 53°C. for 1 hour, and preserving them by the addition of 0.5 per cent phenol. This heat-killed phenolized vaccine is still being employed extensively by many, although recent researches have shown that the immunizing power of the vaccine can be greatly enhanced by the adoption of certain new procedures in the manufacture of the vaccine. These new procedures have been the outcome of studies on the antigenic structure of the typhoid bacillus and the significance of the different antibodies arising from these antigens after immunization.

The old idea was that the typhoid bacillus had only one antigen, that injection of typhoid vaccine gave rise to only one antibody, and that this antibody was protective. The work of Felix in 1924 and others after him soon established the fact that the typhoid bacillus has two antigens—an H or flagellar antigen and an O or somatic antigen, and that O-antibodies were important in protection and not H-antibodies. They also found that after prophylactic vaccination the rise in titre of H-antibodies was far higher than that of O-antibodies, and that the latter was not as high as after recovery from typhoid fever.

The next important advance was made by the discovery that the protection afforded by typhoid vaccine was closely related to the virulence of the culture employed in its preparation and that virulent cultures possessed not only H- and O-antigens but also a Vi-antigen, and that both O- and Vi-antigens represented the essential elements in the vaccine, determining its immunizing capacity. While the function of O-antibodies is to protect the individual against the toxic effects of dead typhoid bacilli, the function of Vi-antibodies is to protect him against the living virulent typhoid bacilli. As these findings have been amply confirmed, it seems justifiable to say that a good typhoid vaccine is one that is made from selected strains of virulent typhoid bacilli rich in both O- and



Vi-antigens. According to the old method of preparation of the vaccine, even when a proper strain is used, the Vi-antigen present is largely lost. The Vi-antigen is remarkably labile and suffers considerable rapid damage by the customary process of making typhoid vaccine—heating and phenolizing. Therefore, special precautions have to be taken to ensure its presence and proper preservation in the vaccine, particularly because it is the most important antigenic component of the vaccine. In the newer method of preparation recommended the necessary safeguards have been introduced.

The so-called 'typhoid vaccine' contains not only typhoid bacilli but also organisms belonging to the paratyphoid group. Studies on the antigenic structure of these organisms have shown that they, like the typhoid bacillus, have H-, O- and Vi-antigens. Paratyphoid A and B possess their own specific Vi-antigens while paratyphoid C possesses a certain amount of the Vi-antigen of the typhoid bacillus. These facts have also to be taken note of.

The first essential in the preparation of any vaccine is to obtain proper strains of the organism concerned and to maintain them in a suitable condition so as to ensure the retention of all antigens present in the organism. In this respect typhoid vaccine is no exception. The strains of typhoid, para A, B and C, selected should contain the maximum amounts of O- and Vi-antigens when tested by agglutination. The strains should also be tested on mice and only the virulent ones used. After the vaccine is made it should be tested for its capacity to stimulate O- and Vi-antibodies in a suitable animal or in man. The ability of these antibodies to confer passive protection to mice against virulent organisms must also be established. Only vaccines conforming to these standards can be considered good vaccines.

In the actual process of manufacture of the new vaccine the organisms are grown on agar and suspended in saline as previously, but are not killed by heat, as heat affects the Vi-antigen. Sterilization is effected by adding alcohol to make a 75 per cent solution. Phenol is not added as a preservative, as that also has a destructive effect on the Vi-antigen. The alcohol employed for sterilization being in itself a preservative is reduced to a 25 per cent strength by the addition of saline and this helps to preserve the vaccine.

This new alcohol vaccine has been found to have very high protective properties. Felix and his co-workers (1941) carried out comparative trials in man with the new and the old type of vaccine and their findings are as follows:—

(1) The Vi-antibody response with the new vaccine was six to seven times greater than the Vi-antibody response with the old vaccine.

(2) The O-antibody response was equally good with both.

(3) The H-antibody response was relatively less with the new than with the old. (This is an advantage.)

(4) The general and local reactions following the injection were markedly milder than those resulting from the use of the old vaccine.

(5) The general and local reactions are of no value as factors contributing to good immunity response.

(6) The immunizing potency of the new vaccine remains undiminished for at least a year.

(7) The doses of vaccine recommended are—

	1st dose	2nd dose
For adult males	.. 0.25 c.cm.	0.5 c.cm.
For adult females	.. 0.2     "	0.4     "
For children (male and female):—		
From 16 to 18 years	.. 0.2     "	0.4     "
"   13 to 15     "	.. 0.1     "	0.2     "
"   9 to 12     "	.. 0.05   "	0.1     "
Under 8 years	.. 0.05	0.05   "

(8) The interval between the two injections is three weeks.

(9) Re-vaccination is advisable after a year and a single dose of the size of the first dose is sufficient.

In the city of Calcutta the incidence of typhoid is very high and prophylactic vaccination is widely practised. There are reasons to believe that the vaccine used in some instances is not the best that can be obtained. There is plenty of scope for improving the method of manufacture of the vaccine in the light of the newer knowledge presented in this short review. If the methods of preparation of typhoid vaccine are checked and the new type of vaccine is prepared with due care and attention to every detail a substantial contribution towards a reduction in the incidence and mortality of typhoid in the city would be made. Let us hope it will be done early.

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## SANITARY ENGINEERING

## CEMENT WINDOWS AND VENTILATORS

By RAI SAHIB KASHI PRASAD, M.B., B.S., D.P.H.  
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## 1. Advantages over windows of other materials

CEMENT structures are elegant, strong and durable. They are proof against fire, rot and white-ants. They neither rust, nor warp. The cost of their preparation is small. Once prepared and fixed into the walls, no further attention or after-care in the way of frequent tarring or painting is required.

For all these reasons cement windows are greatly liked by the village-folk.

## 2. Specifications

(i) *Shape*.—These windows may be round, square or oblong in shape. They may look either like a window with a wooden frame and bars of the same material, or like a perforated cement slab or piece of *jali* work seen in verandahs of modern design.

(ii) *Size*.—The smallest windows or ventilators may be 9 inches in diameter. Others

The two types of cement windows.

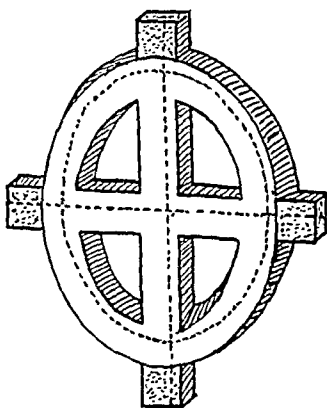


Fig. 1.—Circular with two cross-bars.

may be as large as desired. A good-sized window is 12 inches long, 12 inches wide and one inch deep. It is light, compact and easy to transport. For low-walled huts it will serve as a window; in better class houses it can be fixed as a ventilator.

(iii) *Composition*.—The windows are made of cement and sand, and are reinforced with iron wire. Where available, coal ashes (from railway engines) may also be utilized. The use of coal ashes reduces the cost of construction.

## 3. Manufacture

(i) *Agency*.—They may be manufactured by any intelligent mason who has worked with cement. They may be prepared either at a central place, or actually in the villages by the health leagues, co-operative societies, *gram sudhar sabhas* or rural development *panchayats*.

(ii) *Moulds for casting windows*.—If a composite mould is used the output is large indeed. A trained and practised mason can cast over a 100 windows (1 foot in diameter) per day. Moulds can be either of cement or of wood of good quality, e.g., teak, which is not easily affected by heat and damp. While moulds can be prepared to cast windows of any size, shape or pattern, it is more economical to have a simple design, such as a circle with two cross-

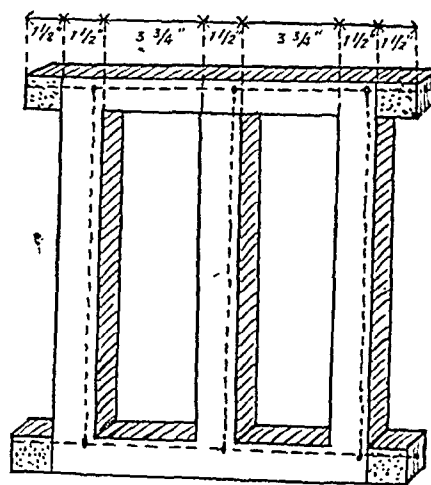


Fig. 2.—In appearance like a wooden window. The dotted lines indicate the reinforcing iron wire. The stippled areas represent the projections which will be embedded in the wall.

bars in it. The edges or walls of the markings (grooves) in the mould should be perpendicular or even bevelled a little, to ensure that the contents slip out easily while the mould is being emptied.

(iii) *Materials*.—The aggregate may be made with 1 part of cement and 3 to 4 of sand, or 1 of cement with 1 of sand and 3 of coal ashes. Iron wire 1/8th to 1/16th inch in diameter should be used in every limb, bar or curve of the window. Kerosene oil is good enough for lubricating the mould. Moulds should be emptied, i.e., windows cast, on a layer of sand, spread out and levelled, to prevent sticking or distortion of the windows.

(iv) *Modus operandi*.—Cut iron wire into pieces of suitable size for a 100 windows and bend them properly to the correct shape. Spread out clean sand and level it on a piece of ground. Prepare the aggregate, oil the mould, fill it with the aggregate and insert iron wire in all the grooves in the mould. Then dry the aggregate in the mould by throwing a little dry

mixture (of sand and cement) over it, work it level, and remove the excess. The mould should then be made to stand vertically on one of its sides, and be emptied out. A few taps with a piece of wood may be necessary to loosen the mass and cast it out. After 24 hours a window can be removed, from over the actual place where it was cast, to a trough of water in which it should lie for a week before being used.

#### 4. General hints

An ordinary-sized window should cost about two annas and six pies in all. To ensure that the windows, especially those in which letters or elaborate patterns are incorporated, are fixed properly in the walls, it will be better to have suitable markings to indicate the outer face and the top of the windows. This can be easily arranged while preparing the mould. To have the maximum of air space the number of bars or curves in the framework of the window should be the minimum and their width no more than an inch or so. At the same time there should not be very large holes to admit birds, etc. The windows ought to have projections on the sides and should be fixed not on the outer face of the walls but actually in its thickness so that they cannot be pulled out easily. They should be supplied to the villagers on a contributory basis. It does not require much persuasion to have them fixed in the front or side walls of houses. To admit pure air, windows should be situated away from drains and dung heaps. They should be at a sufficient height so that privacy in the rooms is not interfered with.

A trained mason in Partabgarh will be willing to go to any district if he is paid at 12 annas to Re. 1 per day and actual railway fare. He will be able to cast as many windows as desired and give training to the local *mistris*.

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## Current Topics

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### Tonsils and Adenoids

By SIR LANCELOT BARRINGTON-WARD, K.C.V.O.,  
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(From the *Practitioner*, November 1940, Vol. CXLV,  
p. 309)

In any children's hospital in this country the condition most frequently demanding treatment and entailing the longest list of patients awaiting operation is 'tonsils and adenoids'. It must therefore be an important problem worthy of constant consideration and re-examination.

At no time in history has preventive medicine attained so powerful a position, and a daily observer of sick children looking back over thirty years appreciates the vast improvement in the general well-being of the child, the better physical condition, the infrequency of certain nutritional disorders, such as rickets, poor dentition, the result no doubt of a higher standard of living, as well as the State care of the child. Yet, during this period, no corresponding reduction in the incidence of 'tonsils and adenoids' has been noted, even allowing for variations of critical standards. In

considering the reason for this, the only constant and unimproving factor has been the British climate, and the only steadily deteriorating one, atmospheric pollution. The former is unlikely to change; the latter is capable of improvement, but it will take time, so that the 'problem of the tonsil' is likely to continue for some generations to come.

The question is often asked, 'What is the function of the tonsils?' Their lymphocytic function is accepted, but they form so small a portion of the lymphatic tissue of the body that it cannot be of great importance. That, with the rest of the lymphoid tissue of the pharynx, they act, when healthy, as a circumoral filter is possible, but the filter tends to get infected. Some consider the tonsils vestigial structures, not of much proven benefit to the individual when healthy, but capable of instituting serious pathological processes. This is no argument for the indiscriminate removal of tonsils; far from it. Ignorance of the function of any organ should make the surgeon doubly cautious in deciding on its ablation. It must be allowed that in the early days, following on the remarkable benefits observed from an improved method of surgical treatment, the attack became too zealous and overshot its objective. Then, not infrequent in therapeutics, the pendulum swung too far in the other direction and an over-cautious policy was pursued. At present the general attitude is intelligent and discriminating, but there is still opposition to the surgical treatment of tonsils on inadequate grounds. Certain objectors are of the conscientious type, which any form of human activity calls into being. They are not open to reason and being small in number are unimportant. Another class, common among laymen holds that the tonsil provides an important but unspecified endocrine substance. It is not possible to deny this absolutely, but all the available evidence is against such a supposition and, if it were true, it is only an argument against removing a normal tonsil. A third class includes the statisticians who, divorced from clinical realities, study figures and produce general statements on the poor results of tonsillectomy. Their attitude is directed against routine tonsillectomy, and no sound clinician ever advocates this. Statistics, moreover, include the results of operations performed competently and incompetently, under good surgical conditions and bad.

Too much stress cannot be laid on the high degree of technical perfection that this operation demands. An operation which is incomplete, which inflicts permanent damage on the pharyngeal structures, which, by reason of shock or loss of blood, devitalizes the child for years, should be avoided at all costs. Skill in the performance of the operation can be attained by anyone of surgical aptitude and average dexterity, who is willing to spend some months of observation and practice in a special clinic. It is not to be attempted by the occasional operator after perusal of a book. Those who consider the tonsil an important part of the lymphatic system lay stress on the frequency with which tonsil remnants, products of an incomplete operation, invariably hypertrophy often to an astonishing degree. This, however, is not the effort of nature to replace beneficent tissue that has been lost: it is merely an example of the rule that incomplete removal leads to increased sepsis, and in response to that sepsis the surviving lymphoid tissue hypertrophies. This secondary hypertrophy is not evidence of a protest by nature but only of inadequate surgery. The same reaction to sepsis is seen in the origin of adenoid hypertrophy. Perfection is hard to reach. Everyone, no matter what his experience and skill, has on occasion suffered the ignominy of observing a small piece of lingual tonsil survive the operation to embarrass later both operator and patient alike. It is important therefore to select a method which makes this eventuality as rare as possible, for it is far better to leave a tonsil untouched than to remove it partially.

#### THE PATHOLOGICAL RESULTS OF THE INFECTED TONSIL

It is now a truism that the size of a tonsil is no criterion of its pathological state. Certain children

have more lymphoid tissue than others, and a tonsil projecting obviously into the pharynx is not necessarily a menace. Sometimes, however, as a result of infection, the tonsil may so hypertrophy that it interferes with deglutition and respiration. At the same time adenoids may obstruct the nasopharynx, and the picture is striking and unforgettable. The correct treatment, operative removal of the tonsils and adenoids, is dramatic in its results. A child with harsh audible breathing, a fitful and snoring sleeper, constantly vomiting for no obvious reason, without appetite, and a bad doer, becomes at once placid, hungry and thriving. Such a case is obvious. The more dangerous tonsil is moderate or small in size, often not visible unless everted by exciting the pharyngeal reflex.

The appearance of the tonsil on inspection may be quite indistinctive. In adults the presence of pus under the *plica triangularis* or in the crypts, follicles plugged with secretion and concretions, present a recognizable picture, but in children there may only be a little injection or oedema of the anterior pillars to suggest an underlying infection. Many different kinds of pathological organisms are harboured in the tonsil, and their relative pathogenicity is hard to assess, and their bacteriology is often misleading.

By its deeds is the tonsil known. It may be frank, repeated tonsillitis, and here it must be remembered that recurrent pyrexia and malaise (without of necessity any complaint of sore throat for the child often does not complain even with a severe tonsillitis) attributed to a chill from bathing on a cold day or sitting in wet shoes and clothes, may be the only external signs of infection.

Enlargement of the tonsillar lymphatic glands, without any general enlargement of other groups, is presumptive evidence that the source of poisoning is the tonsil. It may be merely a temporary phase following a single infection, but if the enlargement persists it is an indication for radical treatment at the source. It is rare to see tuberculosis of the upper deep cervical glands as a primary condition: the usual history is one of acute adenitis, which subsides to become chronic and finally tuberculous. Another direct result of tonsil infection is otitis media. Excluding the blood stream, the only path of infection to the intact middle ear is by the Eustachian tube. This tube is in close relation to the pharyngeal tonsil, and organisms latent or active in the tonsil can initiate and reinforce an inflammation of the middle ear itself. In children, at least, the first step in arresting chronic otorrhoea is to remove the tonsil. Adenoids also play their part, but their action is more obstructive than infective.

In the operative repair of the cleft palate the importance of the tonsil has only been recognized in recent years. A septic tonsil favours post-operative sepsis of the suture line and menaces the success of the operation. It has been found that enucleation of the tonsils as the first step greatly encourages primary union.

The indications for tonsillectomy which have been presented so far, especially recurrent tonsillitis, find fairly general acceptance but operation has been advocated from time to time on other grounds which have been more subject to criticism.

Focal sepsis, as an idea, may have suffered from over-elaboration in the adult, and the tonsils, teeth, appendix, and gall-bladder have sometimes been condemned according to fashion rather than to reason. In the case of the child, however, the general surgeon working in an out-patient department is soon convinced of the influence of the chronic septic tonsil on certain general conditions. Slackness of the musculature leading to scoliosis, genu valgum and talipes valgus, and a lethargic state, can often be ascribed to chronic tonsillitis, and the first step in the treatment must be directed to the source of the underlying toxæmia.

Some systematic diseases are believed to be of tonsillar origin, *e.g.*, rheumatism, chorea, nephritis, but here unfortunately the tonsil is too often only the path of entry, and the damage has been done before attention has been directed to this organ. The question

whether or not the patient who has undergone tonsillectomy is less liable to these catastrophes is difficult to prove, and it is of less importance because no one would advocate the removal of an apparently healthy tonsil because at some period of life the infective agent of rheumatism or nephritis might possibly assail it. It can, however, be suggested with reason that frequent recurrence or exacerbation of the disease, always associated with local signs in the tonsils, is an indication for surgical measures.

#### TREATMENT

Medical treatment is of temporary, rarely permanent, value in chronic infection of the tonsils. Gargles and paints act superficially and cannot reach the recesses which offer abundant cover for micro-organisms. The infected tonsil has little power of natural recovery and, although the sulphonamides may have an influence on an acute infection, there are obvious objections to too continuous or too repeated administrations.

One of the simpler and most successful prescriptions which will keep infection in a tonsil at bay if, for any reason, radical treatment by removal is contra-indicated, is the potassium chlorate and sodium salicylate mixture. (The dosage given here is suitable for a young child.)

R Potassium chlorate	..	..	3 grains
Sodium salicylate	..	..	2½ grains
Sodium bicarbonate	..	..	2½ grains
Syrup	..	..	5 minims
Water to	..	..	60 minims

It should not be given for longer periods than a fortnight, but it will often ward off an attack of acute tonsillitis or, in cases of constant relapse, reduce infection so that operation may be safely performed.

**Adenoids.**—Mild cases of adenoid hypertrophy, sufficient to cause moderate nasal obstruction, should always be given the opportunity of remedial treatment. Many cases improve greatly with corrected diet and habits, and organized breathing exercises. If the condition is advanced, or if it fails to react to physiotherapeutic measures, operation must be performed. Much can be learned from a study of adenoids in cases of cleft palate. Here the precise condition before, during and after operation, can be seen, and it will be observed in adenoid hypertrophy that the lymphoid tissue grows in irregular vertical ridges. If these projections form localized masses, it is possible with a sharp curette to shave them off, leaving the underlying mucous membrane intact: that is the ideal operation. Sometimes, however, the object of the operation is not achieved. The whole mucosa studded with lymphoid follicles is swollen and velvety, and the curette is bound to injure normal tissues, leading to chronic sepsis and adhesions. The removal of adenoids should be performed with the utmost gentleness and the curette should be held as a delicate brush rather than a rake, feeling for the hypertrophied masses and gently sweeping them away.

#### SURGICAL TREATMENT OF THE TONSILS

From time to time certain methods are extolled for the non-surgical extirpation of tonsils. The *electric cauter*, *diathermy*, the *application of pastes* have been offered to those who shrink from the word operation, as efficient methods of destroying the tonsils. Such agents merely fibrose the tonsil to a greater or lesser extent, usually leaving a septic fibrotic mass behind, and neither protect the patient from recurrent attacks of tonsillitis, nor from chronic septic absorption. They have therefore little to commend them. I have no experience of such methods, save in the increased difficulty of dissecting out tonsils which have unsuccessfully undergone this method of treatment. *Radium and x-rays* also have their advocates. In the treatment of malignant disease the risks of these powerful agents and the later tissue changes, of which we have no complete knowledge, are no doubt justified: they cannot be in so simple a condition as tonsillitis.

**Removal of the tonsils.**—I prefer to dissect out the tonsils by the method first introduced by the late

Mr. George Waugh in 1905, and employed ever since by the surgeons at the Hospital for Sick Children, Great Ormond Street, in many thousands of cases. It is a simple surgical procedure which aims at dissecting out the tonsil completely under full vision, with complete control of hæmorrhage and without risk of inhalation of blood or foreign bodies. No special gadgets are required and nothing is left to chance, so far as the human factor can control. As in most operations, the beginner must learn the steps in a clinic and perform many operations under skilled supervision until technical perfection is achieved. The inexperienced and the incompetent operator can do great harm.

There is much difference of opinion as to the age at which operation should be undertaken. Provided that the operation is only done when it has become absolutely necessary, it can be performed at any age. There are no grounds for leaving a child even in the first few years of life, to continue to suffer from repeated sore throats, chronic otitis, or persistent glands of the neck, if these conditions can be cured or improved by tonsillectomy. The operation is a very simple affair to the patient under three. There is little complaint or evidence of pain, and little interruption in the normal life of the child. The only objection raised against operation in these early years worthy of consideration is that the tonsils may grow again. If the tonsil is completely removed, as it should be, there is no more likelihood of this occurring in infancy than in the later years of childhood. The older the child the major the operation. Step by step as the years lead through adolescence into adult life, there is an increase in the discomfort to the patient and the technical demand on the operator. This is not an argument for removing a tonsil that is not condemned, but it influences judgment if the postponement of a necessary operation is raised. In general, operation is preferable in the spring and summer months although if need be, if careful post-operative in-patient treatment for several days is insisted upon, the winter months are no absolute bar.

The preliminaries of the operation are important. There should have been no suspicion of acute infection for at least three weeks. Sometimes it is difficult to catch an interval between mild attacks, but a temperature of even 99°F. should cause postponement of the operation. Sometimes a week's administration of the mixture mentioned above is beneficial. If there is any history at all of previous abnormal bleeding, the coagulation of the blood should be tested and, if any abnormality is found, the whole question of operation must be re-examined. No preliminary purge is given before operation and a liberal allowance of barley sugar is provided.

*Premedication* is of infinite value in children and robs the operation of most of its discomforts. It has been objected that it increases bleeding during the operation, but this has not been my experience. Nembutal given by the mouth is a simple and effective method, if some rules are observed. After administration the child must be kept quiet in a darkened room, preferably without the mother, and anaesthesia should be induced in bed before removal of the patient to the theatre.

*Local anaesthesia* is sometimes employed for adult patients. Its selection is more often a concession to the wishes of the patient, who fears a general anaesthetic, than to the demands of safety or expediency. Any patient who can tolerate enucleation of the tonsils under a local can equally well, whatever his physical state, survive operation under a skilfully administered general anaesthetic. The benefits of the method are not to be denied. As in most instances of infiltration anaesthesia, the dissection is made rather easier by the opening up of tissue planes, and the uncomfortable effects, nausea, vomiting, and headache, which sometimes follow general anaesthesia, are avoided.

In general surgery fairly heavy premedication is the rule when local anaesthesia is employed, but in throat operations this is inadvisable because of the subsequent delay in the recovery of the normal reflexes. Therefore

the surgeon has to deal with a fully conscious patient and this consciousness may interfere with his detachment and put him to some disadvantage.

The details of the anaesthetic are best left to an expert. Induction with ethyl chloride in the child, and gas and oxygen in the adult, followed by ether and oxygen is a common sequence, but it is well to emphasize that complete relaxation of the pharyngeal muscles must be attained.

During operation exact hæmostasis is essential. In children it is rarely necessary to ligate any vessel, but if any bleeding point is active, it should be caught and tied with fine catgut. A suction apparatus is popular with some surgeons, but it is an addition to the armamentarium and is never really necessary. Most operations can be completed with half a dozen pieces of cut gauze.

*Complications.*—The steps of the actual operation need not be repeated here, but it may be of value to consider some of the possible complications. To check the faults of memory, I have analysed a long series of cases. As hospital notes in so minor a condition are often unreliable, and many diverse operators are included under the name of the chief, it seemed wiser to take private cases for which entire responsibility could be accepted, often performed regretfully under conditions which compare unfavourably with hospital. A consecutive series of 1,078 cases since 1924 when a new system of note-keeping was introduced, has been taken.

In the immediate post-operative course *reactionary hæmorrhage*—bleeding within twelve hours of operation—requiring a second anaesthetic has occurred eight times. Should bleeding occur a few hours after operation, dislodgement of the clots and the pressure of a gauze mop, soaked in adrenaline, should first be tried, but if the bleeding persists or recurs, it is wiser to renew the anaesthetic and ligate the bleeding point. Blood transfusion is rarely needed—never in this series—but it should be given if there has been much loss of blood or if the bleeding is due to blood deficiency.

*Secondary hæmorrhage* has been known to occur on the sixth or seventh day. There is often no warning, the whole operation and post-operative course having been most smooth, and the sudden bleeding comes as a disappointing surprise. It is rarely severe and soon ceases, and only once in these records was a ligature considered necessary.

*Bronchitis and pneumonia* have been given as common post-operative complications but there were none in this series, and the risk in properly selected cases has been grossly exaggerated. Recrudescence of an old standing otitis or a septic adenitis are possible sequelæ, but they are understandable in view of the temporary aggravation of the oral sepsis. It is well to warn the patient or parent beforehand that such an event is possible. With the healing of the throat, the activity subsides.

At a recent discussion on the tonsil, *lung abscess* was mentioned but I have never seen a case in which the Waugh method has been employed.

Attention has already been drawn to *incomplete removal* and regrowth of lymphoid tissue. Figures here may be misleading, for a disappointed patient may seek advice elsewhere and the first operator remains ignorant of his failure. Seven in this series are known to have had some degree of recurrence, usually a lingual tag, but for the reasons given the number is probably greater. Nearly 10 per cent of all the cases had had a previous operation on the tonsils. This was more frequent among the early cases, when guillotining was popular and the standard of tonsil operations was generally low. Disappointments occur even after a perfectly performed operation. Soreness of the throat may be felt—probably a rheumatic infection of the pillars—but it is very rare and usually only a temporary discomfort.

*The common cold*, due to a variety of causes, dietetic, allergic, or associated with chronic sinusitis, is not benefited by tonsillectomy, unless the cold always begins with inflammation of the tonsils. Removal of the tonsils in such a case reduces the frequency and



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shortens the duration of infection, without much altering the underlying pathological state responsible.

## CONCLUSION

To sum up, it may be stated that the pathological effects of the tonsil are neither so black nor so white as they have been painted. Absolute indications for tonsillectomy cannot be laid down, and the evidence requires careful sifting before judgment is given. In properly selected cases its performance confers a lasting benefit on the individual.

## Lice and Disease

(From the *British Medical Journal*, Vol. I,  
8th February, 1941, p. 199)

BOTH varieties of the human louse, *Pediculus humanus*, were found in England before this war, but whereas the body louse, *Pediculus humanus corporis*, was seen comparatively rarely, the head louse, *Pediculus humanus capitis*, was much more common. The body louse was usually considered to be restricted almost entirely to vagrants, and although occasionally as much as 5 per cent of a draft of Army recruits has shown signs of infestation, among the general mass of recruits and hospital patients well under 1 per cent have had any body vermin. The head louse, on the other hand, was always exceedingly common. In a recent extensive survey on behalf of the Board of Education and the Ministry of Health Mr. Kenneth Mellanby has shown that in our industrial cities nearly 50 per cent of the girls and 30 per cent of the boys—at least in the poorer sections of the community—had verminous heads during the year immediately before war was declared. The majority of these children had some live lice in their hair and not merely a few nits. In rural districts the situation was much more satisfactory, and it was rare to find more than 5 per cent of any group of country children with head lice, although there is evidence that thirty years ago rural children were as frequently verminous as urban children are to-day. The crab louse, *Phthirus pubis* (often called *Pediculus pubis*), is in peacetime probably about as common as the body louse. Infestation is usually, but by no means always, venereal, and so crab lice may be expected to increase somewhat in wartime. There is probably much less danger of a general infestation throughout the population with *Phthirus* as compared with *Pediculus*, but the possible importance of the crab louse should not be entirely overlooked. The small peacetime reservoir of body lice and the widespread population of head lice might, under conditions favourable to the insects, give rise to practically universal infestation. Unless effective precautions are taken during the war, when so many people are living in shelters and are often unable to change their clothes, and when washing and laundry facilities are among those most easily disorganized, conditions may arise which will be ideal for the louse to increase and multiply.

The life history of both varieties of *Pediculus humanus* is similar: the female lays up to ten eggs a day; these may hatch within ten days, and after a further period of ten days the adults appear. If lice or their eggs are kept away from the body during part of the day their metabolism is reduced and the period of the life history greatly prolonged. At no stage can a louse live more than a month away from man, who is the insect's only source of food. Prof. Buxton has shown that if breeding is not checked a single female might produce 120 daughters and 14,400 granddaughters, and within a short time a small louse population may increase to alarming proportions. The body louse is normally kept in check, except among the few vagrants who are chronically infested, by such simple measures as removing the day clothes at night (this alone will halve the rate of breeding) and by changing underwear, which removes the bulk of both eggs and other stages of the insect. If these things are done regularly, even in the face of frequent

reinfestation, the parasites are unlikely to establish themselves on new host. With the head louse most infestations are fairly light, and the ordinary combing of the hair, though ineffective in exterminating the parasite, serves to keep the population down to fairly small numbers; but if this combing were neglected, even for only a few days, these lightly infested heads would soon bear enormous populations and spread the infestation rapidly elsewhere.

If lice increased greatly their presence and the irritation of their bites would cause a great deal of discomfort, and it is probable that the inability to keep free from parasites might have a dangerous effect on the morale of large sections of the population. The possibility, however, of the appearance of louse-borne disease is of even greater importance. Typhus was formerly not uncommon in England, and if it were reintroduced at a time when lice were common (and transmission by both head and body lice is possible) a disastrous epidemic might occur. It is true that during the last war typhus never established itself on the Western Front, and some workers consider that for this reason it is unlikely to reappear in England, but the risk is one that cannot be ignored. With troops returning from areas where typhus is endemic, the introduction of the disease into England might be difficult to prevent. It must also be remembered that typhus is one of the few diseases that could be introduced by enemy action, for infected lice or infected louse faeces could be spread over our cities from aeroplanes, and the insects would easily survive even if dropped from very great heights. Relapsing fever, transmitted by lice, is also endemic in Eastern Europe, and this disease might similarly be introduced into England. As trench fever disappeared almost immediately after the last war its causation is imperfectly understood, but it is certainly transmitted by lice, and if the insects became common it might well reappear, this time among the civilian population.

If peacetime standards of cleanliness and hygiene can be maintained, then the louse menace will be avoided. It will be necessary to provide abundant facilities for hot baths and obtaining clean underwear for those whose homes have been damaged or where the public utility services have been put out of action. All cities should have ample supplementary disinfection premises available in case of air-raid damage to the usual centre or in case there is a sudden increase in the number of parasites, for it is the disinfection centre that should deal with the very verminous individuals who form the reservoir of body lice. Any measures taken at once to prevent an increase in infestation will be much more effective than those which will become necessary if we wait until the louse population has got out of hand. As well as the simple hygienic measures suggested above, recent research has shown that certain insecticidal powders whose formulae are not yet published may be effective in checking infestation for many days after a single application of the powder to the underclothing. If this work could be put into practice a great advance would be made, and an added protection would be available to those temporarily unable to live under civilized hygienic conditions. But our ideal must always be that such measures, useful as an added protection, should never be considered as the main defence against lousiness.

With regard to the head louse, although this parasite is most common in children, adults are by no means immune, for Mr. Mellanby finds that even in pre-war conditions as much as 10 per cent of adult women may be infested, sometimes very heavily. Even under war conditions these women could keep their heads free from vermin by thorough combing, particularly if this were done by using a specially made fine steel comb; suitable publicity on these lines should prove effective in preventing much increase. Use can also be made of the various liquids available which will easily kill all head lice and their nits; 70 per cent alcohol (made from methylated or rectified spirit and applied so that the hair is kept wet for about an hour) appears quite efficacious and is perhaps the simplest. It seems not unlikely that the war will greatly reduce the incidence



of head lice among children who are evacuated to rural areas. Here they will learn to conform to a new standard of cleanliness by living among people who have come to know that the head louse may be easily dealt with by themselves in the home and who do not therefore feel dependent on a highly organized service provided by the State to deal (as it happens, not very effectively) with such problems. It must be realized that, in the case of both head and body lice, if the people likely to be infested can be made to co-operate in combating possible infestation, then the problem will be far on its way towards solution.

If total extermination is impracticable, it is obviously important that the louse should be kept in check in order to prevent a widespread degree of discomfort, which may be a danger to morale, and to avoid the possibility of louse-borne disease. So far as the body louse is concerned this can be attained by the maintenance of peacetime standards of hygiene. The war may even be made the opportunity for improving the situation by making the nation conscious of the deplorable hygienic standards which allow the degree of infestation by the head louse found even in peacetime.

### The Derris Root Treatment of Scabies

By L. SAUNDERS, M.B., B.S.

CAPTAIN, R.A.M.C.

(Abstracted from the *British Medical Journal*, Vol. I, 26th April, 1941, p. 624)

THE varied factors responsible for the prevalence and transmission of scabies are to a large extent unavoidable, but the question of its prevention and control must be faced in the light of present-day circumstances as one of the most difficult public-health problems. New factors have arisen which probably account for the increase in the incidence of scabies seen in civilian practice. For example, many citizens are now huddled together throughout the night in over-populated shelters where sanitary arrangements are inadequate, and some have been unable to remove their clothes for several weeks. Facilities for bathing have in addition become difficult. It is obvious that with the increasing strain thrown on the medical profession to-day scabies assumes an unpleasant but realistic problem, and one which is becoming unduly prevalent in the Army.

The generally accepted method of treatment in civilian practice is the three-day use of sulphur ointment. Other specific drugs which have been used to destroy the parasite are balsam of Peru, beta-naphthol, and benzyl benzoate. Storax ointment, pernil kathiolan, mitigal, and the sodium-thiosulphate-hydrochloric-acid method all have their advocates. It is often left to the patient to arrange the disinfection of his bedding and clothing: little wonder is it, then, that recurrences are so frequent. The disadvantages of sulphur ointment are: (1) its greasy and messy qualities, whereby pyjamas become quickly dirty and uncomfortable to wear; (2) the disagreeable odour of the ointment; (3) the confinement of patients to their own rooms during the course of treatment; (4) the likelihood of sulphur dermatitis arising from prolonged application, and therefore its danger in inexperienced hands.

All the mentioned methods of treatment essentially require baths and disinfection of bedding and clothing. The treatment detailed below will show that neither bathing nor disinfection of clothing is necessary for obtaining a cure.

Thomas and Miller stated that rotenone in a 1 or 2 per cent lotion produced prompt cure in twenty-four unselected cases. I had been in medical charge of a main dressing station where many cases of scabies were seen, and their results induced me to try the treatment. However, instead of using the rotenone solution, which was relatively expensive and difficult to procure, I made a solution of 4 oz. of derris root powder (from which rotenone is extracted) and 1 oz. of soft soap in one gallon of warm water. The powder was of tested strength and was guaranteed to comply with the requirements of the Ministry of Agriculture as a dressing against the warble-fly.

Derris or tuba root consists of the dried rhizome and roots of the *Derris elliptica* Benth and *Derris malaccensis* Prain, climbing plants that are cultivated in the Federated Malay States, Sarawak, Singapore, Sumatra, and Johore. The powder has a slight odour and a bitter taste, and on inhalation produces a feeling of numbness in the tongue and throat. The root contains up to 10 per cent of the crystalline substance rotenone ( $C_{23}H_{33}O_6$ ), which is known as tuba toxin. Three other crystalline substances—deguelin, tephrosin, and toxicarol—have been isolated. The active constituents are soluble in acetone, benzene, chloroform, ether, and carbon tetrachloride. They are insoluble in water, weak acids, and alkalis. Derris is used extensively in horticulture and agriculture as an insecticide, especially against the warble-fly.

The treatment is of great value where water is scarce and baths are difficult to procure, as in severely bombed areas and in the Middle East. By wearing his clothes the patient is able to carry on with his duties, and expense and trouble are avoided. Thus in the fighting forces the problem of scabies becomes a regimental one and not a hospital responsibility. The strength of units would be better maintained and consequently the efficiency of such units would be raised. Those affected with scabies in shelters would be able to carry out the treatment quite simply in them provided space was set aside for such a purpose.

The advantages of this method are as follows: (1) the treatment is non-odorous, non-greasy, and non-messy; (2) the bed-clothes or underclothes are not stained; (3) it is not expensive—each case costs about a penny for a course of treatment; (4) treatment is standardized at two days' duration; (5) it dispenses with the trouble of having clothes disinfected, thereby avoiding hospital treatment; (6) recurrences are few; (7) supervision is unnecessary; (8) baths are unnecessary.

The disadvantage of the method is that some patients complain of a burning sensation in the region of the scrotum and penis after four or five applications. Three or four days after starting the treatment there may be a very mild excoriation of the affected area, particularly the scrotum, and a scaling and slight exudation of serum may appear. This, however, does not incapacitate the patient, and within a week it usually disappears without treatment. The complication is probably due to the strength of the solution. Since using a half-strength solution on a new series of cases the excoriation has been observed in a very much milder form in only 3 cases out of 50.

## Reviews

**SURGERY OF MODERN WARFARE.**—Edited by Hamilton Bailey, F.R.C.S. Part IV—Compiled by Sixty-five Contributors. Section VIII (Continued)—Wounds of Bones and Joints. Section IX—Wounds of the Face and Neck, including those of the Special Senses. 1941. E. and S. Livingstone, Edinburgh. Pp. from 481 to 640. Illustrated. Price, 12s. 6d. Postage, 6d.

THE destruction of the British Empire cannot be going on quite as fast as Hitler hoped, for we have now received part IV of this ambitious work, written and printed within a few hundred miles of Hitler's air bases and then transported safely some eight thousand miles through seas from which, according to Dr. Goebels, the shipping of the empire has long since been driven. This part however did have a slight setback, in that a number of the chapters were completely destroyed by enemy action, and the publication was further delayed because some of the authors of these destroyed chapters had not kept copies of their contributions. We are glad to think that the authors themselves survived and were able to rewrite their chapters.

In this part the section on the wounds of bones and joints is continued and concluded. It is a very

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important section, as on the correct choice of operation under conditions of emergency the future usefulness of the patient to the community will very often depend, even if his life is not also in the balance. It is a subject in which the makers of artificial limbs should have a say; some of the contributors have given this point due consideration, but others have taken the attitude that immediate surgical considerations must be the guide and afterwards the patient must hope for the best. The very well-reproduced coloured plates of cross sections of the limbs add colour to chapters on amputations, though one cannot help feeling that good line drawings would have served as well.

The next section begins with a chapter on wounds of the face and jaws. Some of the triumphs of plastic surgery are illustrated; this chapter is by Mr. T. P. Kilner, a surgical associate of Sir Harold Gillies who achieved such wonders in this field after the last war. The part finishes with three chapters on injuries to the orbit and eyeball; these include injuries by the action of gas, a horror of war that we have so far been spared but we are taking no risks.

**THE DIAGNOSIS AND TREATMENT OF PULMONARY TUBERCULOSIS.**—By J. B. Hawes, M.D., and Moses J. Stone, M.D. Second Edition. 1940. Henry Kimpton, London. Pp. 260. Illustrated with 75 engravings. Price, 12s. 6d.

THIS little book gives a concise account of the diagnosis and therapeutics of pulmonary tuberculosis with apt observations on the subject. The historical approach is good, and the subject of case-taking is well presented. The sanatorium régime is given in fair detail with up-to-date methods of collapse therapy. The illustrations are good, although some of the legends are not descriptive. The subject of 'follow-up' after the sanatorium treatment does not seem to have received adequate attention; we hope it will be duly considered in the next edition. On the whole, general practitioners and senior medical students will profit by study of this volume.

R. C.

**PRINCIPLES AND PRACTICE OF CHROMATOGRAPHY.**—By L. Zechmeister and L. Cholnoky. Translated from the Second and Enlarged German Edition by A. L. Bacharach, M.A., F.I.C., and F. A. Robinson, M.Sc. Tech., F.I.C. 1941. Published by Chapman and Hall Limited, London. Pp. xviii plus 362. Illustrated. Price, 25s.

THIS is an English translation of the second German edition and is the first account of chromatography published in the English language. The book is divided into two parts. The general section deals with the fundamental principles of the method, the scope of the method, the chromatographic separation of stereoisomers and also of related compounds, and finally an account of the actual procedure, the adsorption media, the solvents and eluents, and a description of the various types of apparatus used for the purpose. The special section, which occupies more than two-thirds of the book, describes with full experimental details, the chromatographic separation or purification of a large and representative class of compounds. The usefulness of this new method is vividly illustrated by the wide scope of its applications. Not only has this been applied to coloured substances such as chlorophyll, haemin, porphyrins, bile pigments, carotenoids, naphthaquinones, anthraquinones, flavins, anthocyanins and other natural and synthetic dyestuffs, but also to colourless substances such as terpenes, sterols, alkaloids, vitamins, hormones, and enzymes. The method has also been applied for the separation of inorganic ions. A bibliography at the end of the book gives all the references collected up to the summer of 1938.

The English translation of a book so valuable for biochemists, analytical chemists, and research workers on a large variety of subjects, should be welcome in all the English-speaking countries of the world.

S. G.

**A CHART FOR FIRST AID TREATMENT OF ELECTRIC SHOCK.** Obtainable from 'Vijalini Duniya' Karyalaya, 5007, Modh Champanori Society, Wadaj Road, Ahmedabad. Price, 9 annas each, Rs. 6 per dozen. Postage extra

IN view of the increasing employment of electricity in industry and the household, it is natural to expect the first-aid treatment of electrical shock to be a familiar subject.

The author, in this chart, has described in English and in Gujarati how to release the victim and to give artificial respiration, with illustrations. He has stated what to do when there are burns on the abdomen, when on the chest, and when there are none. A layman may be puzzled when he encounters burns on both.

More importance might have been laid on the necessity of calling a doctor as quickly as possible, as a patient may require lumbar puncture, intracardiac injection and/or respiratory stimulants.

The price of the chart is perhaps a little high.

R. C.

**SULPHONAMIDES IN GENERAL PRACTICE.**—By M. L. Gujral, M.B., M.R.C.P. (Lond.). 1941. Published by the author (1, Curzon Road, New Delhi). Pp. 106.

THE introduction of the sulphonamide group of drugs for the treatment of bacterial diseases is a distinct landmark in the conquest of disease. This small book provides a fairly good account of the subject with reference to the mode of action, dosage, uses in various diseases and toxicity of the drug. The author has collected in it facts which should be known to practitioners in order that they may be able to exploit chemotherapy with efficiency and safety. The likelihood of serious harm resulting from their indiscriminate use has been stressed.

We have however one criticism to offer, namely that the use of sulphonamides in the local treatment of wounds seems to have been overlooked.

R. C.

**ANTIQUITY OF HINDU AND GREEK MEDICINE.**—By Dharendra Nath Banerjee, M.B. (Cal.), M.D. (Berlin). 1941. Published by Mr. A. Roy of the Medical Bureau, 50, Chowringhee Road, Calcutta. Pp. 18. Price, 8 annas

THIS is a reprint of a lecture, now published at a very modest price.

It provides a rapid review of the history of medicine from the earliest historical times, with particular emphasis on Indian medicine.

## Abstracts from Reports

### REPORT ON THE ADMINISTRATION OF THE EXCISE DEPARTMENT IN THE PRESIDENCY OF BENGAL FOR THE YEAR 1939-40

**Ganja.**—The total quantity of ganja consumed in the province amounted to 866 maunds 31 seers as against 848 maunds 37 seers, showing a net increase of 17 maunds 34 seers or 2.1 per cent of the people. Though there was a fall in the consumption of the drug in French Chandernagore in comparison with the issues of the last year, the issues to that settlement are still heavy. As against 1,665 seers in 1938-39, this settlement took 1,470 seers of ganja during the year under report which is just 23 seers less than the total amount of ganja consumed in the Hooghly district. There would appear to be some justification for believing that a large portion of the ganja finds its way back to British India.

Two maunds five seers of ganja were issued at the concession rate of duty of Rs. 15 per seer for the manufacture of medicinal preparations by chemists against 4 maunds 10 seers in the preceding year.

**Bhang.**—The demand for bhang was mostly confined to the West Bengal districts. In some of the districts in East and North Bengal, bhang grows wild. In one district headquarters town it was observed growing along most of the municipal roads, beside the jail walls and most luxuriantly of all in the collectorate. Where the plant grows in such profusion, its extensive use as an illicit substance for bhang and partly also for ganja is hardly to be wondered at. There has been a considerable decline in the use of bhang by village kabirajes, as it is reported that the patients prefer either the products of one or other of the advertised ayurvedic pharmacies, or the medicines of the charitable dispensaries. The total quantity of bhang consumed in the Presidency amounted to 222 maunds 38 seers against 230 maunds 16 seers in the previous year, showing a decrease of 7 maunds 18 seers.

No case of abuse of medicinal preparations manufactured from the drug was reported during the year, but as mentioned in last year's report there is need for strict control of the kabirajes.

**Charas.**—The total quantity of charas imported by the wholesale dealers at Birbhum and Calcutta into the Province was 21 maunds 1 seer 13 chittaks against 21 maunds 9 seers 6 chittaks in the previous year, showing a decrease of 7 seers 9 chittaks. Owing to the restrictions imposed by the Punjab Government on the supply of charas to this province, 1 maund 15 seers 8 chittaks and 13 seers 5 chittaks of confiscated charas out of the stocks of such charas in the Calcutta Excise Office and Central Detective Department, respectively, were issued to the wholesale dealer at Calcutta to meet the demand.

Two maunds fourteen seers eleven chittaks of charas were exported to the Consulting Chemist, Treasury Department, Washington (America). The total issues to retail shops were 23 maunds 18 seers against 19 maunds 30 seers in the preceding year, showing an increase of 3 maunds 28 seers or 19 per cent. The actual consumption in Calcutta amounted to 14 maunds 15 seers against 9 maunds 7 seers in the previous year, showing an increase of 5 maunds 8 seers due to the restrictions of the illicit sale of the drug in small quantities through *pan* shops and *birwallas*. From 1937-38 the increase in consumption in Calcutta was 6 maunds 27 seers or 86 per cent. The consumption in the other districts was not appreciable, the heaviest consumption outside Calcutta being in Burdwan (2 maunds 22 seers). In Howrah with its two shops the total consumption was only 11 seers and in Rajshahi it was 3 seers.

Thirty seers of charas were exported to French Chandernagore during the year against 18 seers in the previous year.

**Opium.**—The consumption of excise opium during the year under report was 655 maunds 28 seers as compared with 662 maunds 33 seers of the previous year showing a decrease of 7 maunds 5 seers or 1 per cent. In some districts there is evidence that with the increase in the retail price many consumers have taken smaller supplies of the drug, and there is evidence extending over a series of years that the younger generation is not taking opium, and that, at any rate in *mofussil* places, as veteran opium eaters die of old age, the demand for the drug falls.

The use of morphia as a substitute for opium does not appear to have been prevalent in any district of the province. The doping of children with opium pills was not reported from any district. The habit of opium smoking is prevalent among a few Chinese and Tibetan residents in Darjeeling as well as amongst the Mughls in Barisal. The Opium Smoking Act and the rules made thereunder were administered as efficiently as possible. This Act is hedged about with restrictions which go far to render it useless as a practical measure for tackling the vice of opium smoking. Effective action can only be taken under the rules made under the Opium Act.

**Cocaine.**—There is no evidence of the use of cocaine as an intoxicant and the habit is unknown in almost all the districts of the province except that it is reported to exist in a very limited extent in the

districts of Calcutta and Dacca and in the mill areas of the 24-Parganas and Hooghly districts.

## ANNUAL REPORT OF THE MYSORE STATE MEDICAL DEPARTMENT (WITH THE GOVERNMENT REVIEW THEREON) FOR 1939

At the close of the year 1939, the total number of medical institutions in the State was 330, compared with 311 at the close of the previous year. One private-aided institution at Mandagadde was closed and twenty new institutions were opened during the year. The latter include two tuberculosis institutions, six local fund dispensaries on a reduced scale, nine subsidized rural dispensaries and three malaria relief centres.

The number of beds available for in-patients was 3,210 as against 3,056 in the previous year. A total number of 65,285 in-patients was treated in the various hospitals and dispensaries as against 61,537 in the year 1938. The number of out-patients treated was 6,140,706, as against 5,612,993 in the previous year. The total number of parturition cases was 33,093, of which 13,808 were attended to inside the institutions.

The number of midwives working during the year was 339 as against 335 in the preceding year.

Under the scheme for the subsidizing of medical practitioners in rural areas, nine appointments were made during the year, making a total of sixteen such practitioners working in the State.

A sum of about Rs. 1,49,000 was received as donations during the year, either for the construction of buildings or for equipment.

Eight new buildings were completed and opened for work, among which mention may be made of—

- (i) The Cheluvamba Hospital, Mysore.
- (ii) The Lady Willingdon Tuberculosis Clinic and Dispensary at Bangalore.
- (iii) The Tuberculosis Dispensary at Davangere.
- (iv) The new pathological block of the Krishna-rajendra Hospital at Mysore.

The Boards of Visitors of the several medical institutions continued to evince interest in their improvement and made valuable suggestions to increase their usefulness.

A special grant of Rs. 1 lac was made during the year for providing up-to-date surgical instruments and other equipment to the major hospitals in Bangalore and Mysore, the district hospitals and certain selected local fund dispensaries, so as to bring the most modern methods of diagnosis and treatment within the reach of the rural population.

A State Tuberculosis Association was formed for the organization of a State-wide campaign against tuberculosis and for operating the State's share of the funds of the King-Emperor's Anti-Tuberculosis Fund.

## KASHMIR MEDICAL MISSION OF THE CHURCH MISSIONARY SOCIETY: REPORT FOR 1940

In spite of the war in Europe in which every part of the Empire is involved, we have been enabled to carry on without curtailing any part of our work, without having to turn away a single patient from our doors through lack of funds, or to refuse admission to any of the over two thousand needy in-patients who have occupied our wards, and without having to dismiss a single member of our staff. This is indeed something to be truly thankful for.

Owing to the war we have, as was only to be expected, received much less than usual in the way of bandages from England, and so we are especially grateful to the ladies in Srinagar who have come forward to our help, and either knitted, or made bandages for us, which have been extremely useful.

We quote with pleasure from His Excellency the Viceroy's speech on the occasion of the laying the foundation stone of the new State Hospital, last October.

'On an occasion such as this, I should like to pay a tribute to the excellent work in the medical field which has been done in the past and is still being done in Kashmir by the mission hospitals. They have indeed played an important and valuable part in the development of institutional treatment, and their share in the medical system which has been built up in the State is a worthy one.'

### THE PREMANANDA FREE CHARITABLE OUT-DOOR LEPRO DISPENSARIES, CALCUTTA: ANNUAL REPORT FOR 1940

#### LEPROSY IN CALCUTTA

It is becoming clear to those who have studied the leprosy problem in Calcutta that we must have, as soon as possible, a modern leper colony. Leprosy in a city like Calcutta must be tackled by four types of institution.

1. The outdoor clinic. Most patients, especially in the earlier stages, are not infectious, and do not need indoor treatment. Outdoor clinics such as ours are primarily useful for such people, and can also become centres of preventive work.

2. A hospital, to which those who need temporary hospital treatment can be sent.

3. A colony, for those who need more thorough treatment than an outdoor dispensary can give, and to which those who are in an infectious state can be sent. This should be well away from the town, in as healthy a district as possible.

4. A home, where those who are so advanced in the disease that they are not likely to be cured can be cared for. Most of the street beggars would come under this category. This home could be run in conjunction with the colony but would have to be distinguished from it.

At present Calcutta is fairly well provided with 1, though further branch dispensaries might well be opened. Gobra Leper Hospital provides an ideal 2, but at present is also being used as 3 and 4 for which it is quite unsuitable, and very few beds are left for real hospital cases.

On the other hand 3 and 4 are entirely lacking. The only colonies in Bengal are small ones serving mofussil areas, all overcrowded. The result is that the dispensaries in Calcutta are crowded with patients who are highly infectious, and whose only chance lies in treatment in a colony, and the lack of such a place, and the extreme difficulty of finding room for hospital patients in Gobra are the greatest handicaps on our work.

The chief event of the year has been the completion of the new building at Maniktola. The main structure consists of a large room downstairs for examination and treatment and a smaller room for dressings, and corresponding rooms upstairs which serve as laboratory, office and store. Part of the old building has been reconstructed to form an adequate dispensary and a smaller building provides quarters for the caretakers, and latrines. There is also a verandah for waiting patients.

The new quarters provide first of all proper conditions under which the staff can work, and the work has hereby gained in efficiency. We are also able to do all our own laboratory work and to carry out tests which were not possible before. Also respectable premises increase the confidence of the public, and an increased attendance is already noticeable.

The total number of patients who attended for treatment during the year was Maniktola 1,438, ordinary patients and 250 beggars, who are classified separately; and at Kalighat 567 and 46 beggars. The total attendance was 33,147 at Maniktola and 13,466 at Kalighat. The average daily attendance was 131.5 for Maniktola with 252 working days, and 87.4 for Kalighat with 154 working days.

Of our patients 1,113 at Maniktola and 468 at Kalighat attended sufficiently regularly to justify re-examination at the end of the year. The following

results were obtained. Last year's figures are in brackets.

Disease arrested, Maniktola 75 (71), Kalighat 36 (39).

Much improved, Maniktola 344 (301), Kalighat 162 (115).

Slightly improved, Maniktola 332 (179), Kalighat 146 (81).

No change, Maniktola 361 (60), Kalighat 124 (58).

Worse, Maniktola 1 (4), Kalighat nil (1).

#### HOME VISITING

Our laboratory assistant spends part of his time visiting those patients who have discontinued treatment in order to persuade them to return, explaining to them the serious nature of the disease and of the danger to which their family is exposed. He paid 238 visits, but was only able to trace 55 patients, of whom 44 returned for treatment.

The next improvement, most urgently needed, is the provision of new premises at Kalighat. This will require a large sum of money. The committee has already been able to set aside Rs. 3,000 as the nucleus of a building fund but this must be augmented by a large grant from the Government or the Corporation; application is being made in the proper quarter.

This must be our first objective, but we have not lost sight of the need of branches in other parts of the city which are badly infected with leprosy.

### ANNUAL REPORT OF THE CHEMICAL EXAMINER'S DEPARTMENT, GOVERNMENT OF MADRAS, FOR THE YEAR 1940

#### Human poisoning cases

The total number of human poisoning cases examined during the year was 427 cases with 2,438 articles as compared with 458 cases with 2,605 articles in 1939. Poison was detected in 235 cases or 55 per cent.

Among the organic poisons opium heads the list with 34 cases while datura and oleander come next with 25 cases and 24 cases respectively. Among the inorganic poisons copper sulphate claimed 25 cases while arsenic claimed 15, mercury 12 and arsenic and mercury together 6 cases.

#### INTERESTING CASES

**Arsenic.**—A quack prepared a 'specific' for leprosy for a neighbour suffering from this disease. The patient was suspicious and wanted to test the medicine before he consumed it. He gave small portions of the medicine to each of two children. They were both taken seriously ill and one of them died. We detected arsenic in minute quantities in the viscera. The police were unable to secure the remainder of the medicine for analysis but they seized from the house of the quack a mortar and pestle which had been used for grinding the medicine. The washings of the mortar and pestle revealed white arsenic weighing about one and nine-tenths grains.

**Mercury.**—On the day after the Pongal it is the custom in some villages in South India to catch a fox in the forest and to march it in a procession through the village. While such a procession was approaching the village with a fox, the accused greeted the crowd with sugar packets which he distributed amongst them by way of celebration of the birth of a son to him that morning. One member of the crowd ate the contents of one packet, which were sweet. A little later another packet was offered to him by the accused. The contents of the second packet were irritating to the taste and the victim vomited several times. Some of the vomits were eaten by two dogs which died. The victim was taken very ill and removed to a hospital where he recovered after his stomach was washed out. The stomach contents were sent to us and we detected about three grains of corrosive sublimate in them.

**Copper.**—Most of the cases of copper sulphate poisoning were attempted suicides. A young man wanted 'to solve the problem of unemployment'. He was admitted to a hospital and recovered after a stomach wash. We detected in his stomach washings copper

equivalent to about six grains of crystalline copper sulphate. He was convicted for attempted suicide but released on probation of good conduct.

There were also some accidental cases of copper sulphate poisoning and these could be explained only by the omnivorous nature of some human beings. One young man found a blue lump on the floor of a latrine and ate it thinking it to be candy. Another found a packet containing cashew nut kernels mixed with blue stone pieces in front of a cinema and ate the lot in spite of the disagreeable taste. Still another found a packet of blue stone lying on the road and ate the contents. Vomiting ensued in each of these cases, and recovery followed after removal to hospital. We found small quantities of copper in the stomach washings of each of these victims.

**Yellow phosphorus.**—A man was invited to dinner. After eating a few morsels of food served to him, he was seized with an uneasy sensation in the stomach and vomited. He reported the matter to the police who seized the uneaten food and sent it to us along with a bottle containing a yellow lump immersed in water which was found in the house of the accused. We detected yellow phosphorus weighing about two-fifths of a grain in the food, and the lump in the bottle was yellow phosphorus.

**Nitrite.**—After dinner at about 6 p.m. a man told his wife that he was having abdominal colic. His wife gave him a powder believing it to be sodium bicarbonate. After swallowing the powder he went into the street but soon returned home stating that he was feeling giddy and that the pain in the stomach was intense. He vomited and purged once and lay breathing hard on a mat. He was found to be dead at about 8 p.m. The post-mortem examination revealed bleeding from the mouth and nose, features livid; the lungs dark red in colour and the liver, pancreas, spleen and kidneys congested. The stomach was distended with food and gas the outer surface being vascular and injected. The small intestines were slightly injected. We detected in the viscera nitrite equivalent to about three and one-fourth grains of sodium nitrite, in the vomit nitrite equivalent to about half a grain of sodium nitrite and in the motion nitrite equivalent to about one-fiftieth of a grain of sodium nitrite.

A rag bundle stated to contain the specimen of sodium bicarbonate administered to the victim was sent to us by the police. The bundle was actually found to contain sodium nitrite tied up in one corner of the rag and sodium bicarbonate contaminated with traces of sodium nitrite tied up in the opposite corner of the same rag.

**Alcohol.**—One morning a young man went to an arrack shop and went on drinking till he had consumed about five rupees worth of arrack. He was removed to a hospital in a comatose state in the afternoon, and died just before midnight without recovering consciousness. The post-mortem examination revealed features flushed, heart normal, lungs intensely congested, liver forty-two ounces in weight and congested, pancreas, spleen and kidneys congested, stomach with injected patches all over the inner surface and containing a dark greenish fluid smelling of arrack, intestines injected in places and the brain fifty ounces in weight and congested. We detected alcohol but not any other poison in his stomach washings and in his viscera. Considering the fact that about three pints of arrack can be bought for five rupees and that arrack as sold to the public is thirty-five degrees under-proof, it is probable that alcohol equivalent to about a pint of anhydrous alcohol had been drunk by the victim. About a quarter of a pint of anhydrous alcohol is regarded as a fatal dose.

**Datura.**—A man in the Andaman Islands was suspected of being in possession of some mysterious Burmese poison which would produce unconsciousness in small doses and would kill in large doses. The police raided his house at 3 a.m. and found a packet inside his pillow. They sent the packet on to us and we found the contents of the packet to be powdered datura seeds.

## THE REPORT ON THE WORKING OF HOSPITALS AND DISPENSARIES IN THE PUNJAB FOR THE YEAR 1939

DURING the year under report the total number of medical institutions in the province was the same as in the preceding year, namely, 974. The civil hospitals at Dharamsala, Isakhel and Pakpattan, and the hospitals for women at Dharamsala and Hazro were provincialized. The number of rural dispensaries, for the maintenance of which district boards receive a grant-in-aid from Government, remained unchanged. The expenditure incurred by Government in the grant of a fixed travelling allowance of Rs. 10 per mensem each to the medical officers in charge of these dispensaries to enable them to visit neighbouring villages within a radius of five miles has justified itself, inasmuch as 243,000 patients were treated in their villages or in their homes. In order to bring medical relief within still easier reach of the rural population, Government have now adopted a scheme of subsidizing private practitioners to encourage them to settle in villages. Sixty-three subsidized dispensaries were established before the end of the financial year 1939-40, and more will be set up gradually as funds permit.

The total number of patients treated both indoor and outdoor was 176 lacs against 171 lacs in the preceding year. As there was no epidemic during the year under report, the increase in the number of patients treated in hospitals and dispensaries can only be interpreted as an indication of increased willingness on the part of people to resort to a hospital for treatment. Malaria was not unduly prevalent, but the number of cases treated for this disease rose from 14.9 lacs to 16.7 lacs. There is an increase of 77,250 in the number of patients who were treated for diseases of the eye.

The total income of all hospitals and dispensaries rose from Rs. 53.4 lacs to 54.7 lacs, the increase being almost entirely due to larger receipts under the heading 'Contributions from local and municipal bodies'. In recent years several charitably-disposed persons have donated large sums of money for the treatment of tuberculosis patients. The tuberculosis hospital at Amritsar, which was opened during the year under report by Her Excellency the Marchioness of Linlithgow, is the outcome of the munificence of Rai Bahadur Gujjar Mal after whom it is named. Another sanatorium, for the construction of which funds have been provided by Rai Bahadur Jodha Mal Kothiala, will shortly be ready in the vicinity of the city of Hoshiarpur. The sons of the late Rai Bahadur Bawa Dinga Singh have donated Rs. 1 lac for a tuberculosis hospital at Lahore to be named after their father.

There was noticeable expansion in the institutions which provide medical treatment for women exclusively. A maternity hospital under the charge of a woman assistant surgeon was opened at Montgomery. An indoor maternity home known as the Shrimati Janki Devi-Jamiat Singh Hospital containing 16 beds was built at Lahore, the money having been raised by contributions from private individuals and a grant-in-aid from Government. Separate female sections were provided in seven civil hospitals at *tahsil* headquarters. The number of assistant surgeons in the women's branch of the Punjab Civil Medical Service has increased from 3 to 7; and the provincial cadre of women sub-assistant surgeons has been strengthened by the addition of 8 posts, raising the total to 55. Satisfactory progress has also been made in the training of *dais* by the grant of scholarships. The Lady Aitchison Hospital, Lahore, which is in charge of a member of the Women's Medical Service, retained its usual popularity and high standard of efficiency.

The Mayo Hospital, Lahore, maintained its high reputation. It can now boast of a most up-to-date x-ray plant which has been installed at a cost of Rs. 1 lac and a Radium Institution for which L. Tirath Ram gave a generous donation of Rs. 50,000. The bed accommodation at present is insufficient but will be increased as soon as funds become available for the



construction of new buildings on the site which Government have acquired close by at a cost of Rs. 6½ lacs from the authorities of the Forman Christian College. The civil hospital at Amritsar, which *inter alia* provides practical and clinical training for students of the medical school, has also another year's useful work to its credit. Its medical superintendent is now a lecturer of the school instead of the civil surgeon. It has a separate eye hospital with accommodation for 150 indoor patients which is fully utilized, although not yet properly equipped for reasons of financial stringency. There was an all-round increase in the work done at the Lady Willingdon Hospital, Lahore. The Tika Devi Health Centre works in close association with the hospital, and a scheme has been introduced which enables students to conduct midwifery cases under proper supervision at the patients' homes. The clinical material is, however, not yet sufficient for the training in practical midwifery of all students of the King Edward Medical College, and some have still to be sent to Madras.

A 'blindness week' was held in February 1939, and was inaugurated with an appeal from His Excellency the Governor for the help and co-operation of all who valued the gift of sight. The publicity and propaganda side of the week was entrusted to the Commissioner for Rural Reconstruction who printed literature in several languages for distribution, on a large scale. Arrangements were made with the co-operation of All-India Radio, Lahore, for broadcast talks on the prevention of blindness by eminent eye specialists in the province. Medical officers in districts played their part by touring and lecturing in villages, giving demonstrations on the care of eyes, examining cases of defective vision and treating cases of eye diseases. Reports which were received about the celebration of the week were encouraging and showed that it had been a great success.

## Correspondence

### INSULIN REQUIREMENTS IN INDIA

SIR,—Will you or any one of the readers of your journal be good enough to let me know either through the columns of your esteemed monthly or otherwise about the source of getting insulin in these war days? And if it cannot be procured easily in India, what is the best possible treatment for a diabetic?

BAL RAJ VIJ,  
Palace Physician.

KHILCHIPUR STATE (C. I.),  
KHILCHIPUR,  
4th August, 1941.

### INSULIN REQUIREMENTS IN INDIA

SIR,—With the war-cloud spreading rapidly in different zones, particularly in the East, there is an increasing difficulty in India in getting supplies of some of the essential life-saving drugs, for which India still depends on foreign countries. One, therefore, naturally fears what will happen to those unfortunate individuals the continuance of whose life depends on a regular and uninterrupted supply in their proper doses of those drugs which are not manufactured in India.

Insulin appears to me to be such an essential drug and it is very unfortunate that, though nearly 20 years have passed since the discovery of insulin, its manufacture has not been taken up in India. That insulin can be manufactured in India, there is no doubt. As a matter of fact, during the early days of insulin therapy, when the export of the drug to India was limited, the writer with the collaboration of Col. T. C. Boyd, the then chemical examiner to the Government of Bengal, prepared insulin in the laboratory which was found to be of quite good potency. The reason why the research was not continued was, firstly, because

the cost of preparing insulin on a small scale in the laboratory was prohibitive and, secondly, because we began to get adequate supplies from abroad.

There is no gainsaying the fact that the life of most diabetic patients depends on insulin and there is also no denying the fact that India, most particularly Bengal, is one of the leaders so far as the incidence of diabetes is concerned. The death rate is also high. Insulin thus is one of the most essential drugs, and, now that the supply is gradually getting scarce, it is high time that the medical profession in India should devise ways and means for its manufacture in India. The manufacturing firms, as far as I know by talking to a few of them, appear to be nervous as to what their fate would be when the war is over and the insulin market flooded with all sorts of foreign insulin. They apprehend that even if they produce the properly standardized insulin, they would not be in a position to compete with the foreign production unless they get Government support and backing in several ways. Personally, I think their fear is not well founded. If the Indian insulin satisfies the physiological tests and is carefully standardized as regards potency, etc., and certified by a Board as such, I do not know why it will not sell as well as the others and at a price which may be said to be competitive.

The reason of my approaching you through these columns is obvious for the following reasons:—

(1) Insulin is the life of the huge diabetic population in India, particularly of the aristocratic, the intelligent and middle classes, and if by chance the supply is interrupted, or stopped, the death rate which will follow will be appalling.

(2) The manufacture and the standardization of insulin can be taken up by any of the big manufacturing concerns in India.

(3) Insulin production in India would be an asset and will prove to be so in the long run.

May I have your sympathy and co-operation in the name of the very large number of the unfortunate diabetic patients in this country?

J. P. BOSE, M.B., F.C.S. (Lond.).

SCHOOL OF TROPICAL MEDICINE,  
CALCUTTA,  
15th August, 1941.

[Note.—It is true that at present many doctors and patients prefer drugs of British or American manufacture, not because they are British or American, but because they are made by firms with established reputations. The present situation seems to present the pharmaceutical trade in India with a splendid opportunity. If during the war firms can establish their reputations they will certainly be able to compete with foreign pharmaceutical products.

Apparently, according to Dr. Bose, certain manufacturers are holding back until they can get some guarantee of Government protection to be maintained after the war. Whilst a promise of protection for a limited period, so that they will have time to recoup their original outlay, would be fair, we do not think that it would be right for them to use this shortage of insulin to blackmail the Government into promising a degree of protection that would later react to the disadvantage of the diabetic patient.

We understand that an enterprising firm in Bombay are already exploring the possibilities of manufacturing insulin in India.—EDITOR, I. M. G.]

### BACTERIOPHAGE AND WATER CONTAMINATION

SIR,—Whilst in no way attempting to belittle the interest and importance of Major Paricha's and Dr. DeMonte's findings recorded in their paper 'Bacteriophage as an Index of Water Contamination' in your issue of August 1941, I feel that the unfortunate public health analyst would be hard put to it to pass any water sample as potable if the authors' suggestion to include examination for these bacteriophages in the routine examination of water were to be adopted.



One may accept, I think, that such bacteriophage contamination of water indicates that the water has at some time been contaminated by human excreta, but I venture to suggest that there are few, if any, water supplies which have not been so contaminated somewhere during the course of their passage from the rain after it has fallen on the ground to the actual source of supply to the consumer, be this water tap, spring, well or tank.

Surely the purity of water, in the sense of its freedom from pathogenic organisms, depends, whether naturally or artificially produced, not on its never having been contaminated but chiefly on its having undergone filtration through the ground or through filter beds and on the relatively poor hold on life exhibited by the pathogenic intestinal bacteria outside the human body.

But bacteriophage is a filter-passer, and it is also a pretty hardy organism. It would not be removed, I suggest, either by natural or artificial filtration, or by reasonable storage and perhaps not even by ordinary chlorination, though I have no facts to support the latter suggestion.

*I suggest that even London's tap water, which comes from a highly contaminated source originally and which yet, after treatment, maintains a very high standard of purity, would be found contaminated with bacteriophage active against pathogenic bacteria and would therefore presumably be condemned if absence of this contamination were regarded as a necessary criterion of potability.*

L. A. P. ANDERSON,  
LIEUTENANT-COLONEL, I.M.S. (Retd.).

PASTEUR INSTITUTE,  
SHILLONG,  
27th August, 1941.

## Service Notes

### APPOINTMENTS AND TRANSFERS

#### *To be D. M. S. in India*

MAJOR-GENERAL A. C. MUNRO, K.H.P. Dated 12th July, 1941.

Lieutenant-Colonel H. K. Rowntree, M.C., I.M.S. (Retd.), Director of Production, Instruments and Appliances, is appointed Additional Deputy Director-General, Indian Medical Service (Stores), for the duration of the war, with effect from the 3rd July, 1941.

On his reversion to military duty Lieutenant-Colonel Amri Chand, Professor of Medicine, K. E. Medical College, Lahore, made over charge of his duties to Major G. F. Taylor, Professor of Clinical Medicine, K. E. Medical College, Lahore, on the afternoon of the 14th July, 1941. Major Taylor will hold this charge in addition to his own duties till further orders.

The services of Lieutenant-Colonel W. H. Crichton, C.I.E., are replaced temporarily at the disposal of His Excellency the Commander-in-Chief, with effect from the 29th May, 1941.

On his reversion to military duty Lieutenant-Colonel K. R. Batra, Civil Surgeon, Jullundur, made over charge of his duties to a non-I.M.S. officer on the forenoon of 8th July, 1941.

On his reversion to military duty Lieutenant-Colonel H. Chand, M.C., Civil Surgeon, Sialkot, made over charge of his duties to a non-I.M.S. officer on the afternoon of the 10th July, 1941.

The services of Lieutenant-Colonel S. D. S. Greval are placed temporarily at the disposal of His Excellency the Commander-in-Chief, with effect from the afternoon of the 12th July, 1941.

On his reversion to military duty Lieutenant-Colonel H. S. Anand, Professor of Physiology, K. E. Medical College, Lahore, made over charge of his duties to a non-I.M.S. officer on the afternoon of the 14th July, 1941.

On his reversion to military duty, Lieutenant-Colonel Jamal-ud-Din, Civil Surgeon, Rawalpindi, made over charge of his duties to a non-I.M.S. officer on the forenoon of the 14th July, 1941.

Lieutenant-Colonel M. Das, M.C., Superintendent of the Alipore Central Jail, made over executive and medical charges of the Alipore Central Jail to Mr. Chas. A. W. Luke and Lieutenant-Colonel K. S. Thakur, respectively, on the afternoon of the 15th July, 1941.

The services of Lieutenant-Colonel A. C. Chatterji, Director of Public Health, Bengal, are placed at the disposal of the Government of India in the Defence Department, with effect from the 15th August, 1941.

The services of Major C. K. Lakshmanan, Deputy Public Health Commissioner with the Government of India, are placed at the disposal of the Chief Commissioner, Delhi, for appointment as Chief Health Officer, Delhi, with effect from the afternoon of the 28th May, 1941, vice Lieutenant-Colonel W. H. Crichton, C.I.E.

The services of Major J. D. Grant, an Agency Surgeon, are temporarily replaced at the disposal of His Excellency the Commander-in-Chief, with effect from the 15th May, 1941.

On return from leave Major S. Smyth resumed charge of his duties as Civil Surgeon, Lahore, on the forenoon of the 23rd June, 1941, relieving Major G. F. Taylor, Professor of Clinical Medicine, K. E. Medical College, Lahore, of the additional charge.

The Secretary of State for India has appointed to the Indian Medical Service (Civil) the following officers of the Indian Medical Service, with effect from the dates stated against their names:—

#### *Central Government*

Captain C. J. H. Brink. Dated 3rd February, 1940 (forenoon).

Captain H. A. Ledgard. Dated 27th March, 1940 (forenoon).

#### *Madras*

Captain G. E. S. Stewart, M.B.E. Dated 16th January, 1940 (forenoon).

Captain W. H. G. Reed. Dated 31st January, 1940 (afternoon).

#### *Bombay*

Captain T. M. Williams. Dated 22nd February, 1940 (forenoon).

Captain W. W. Laughland. Dated 23rd February, 1940 (afternoon).

Captain T. C. M. M. Morrison. Dated 27th February, 1940 (forenoon).

Captain C. C. Harvey. Dated 26th May, 1940 (forenoon).

#### *Assam*

Captain J. H. Caverhill. Dated 12th April, 1940 (forenoon).

#### *North-West Frontier Province*

Captain M. Ata-Ullah. Dated 22nd February, 1940 (forenoon).

#### *Sind*

Major A. K. M. Khan. Dated 22nd February, 1940 (forenoon).

Captain G. S. Chopra, A.I.R.O. (Medical), is appointed to officiate as Deputy Assistant Director-General (Medical Stores), Karachi, from the forenoon of the 18th June, 1941, until further orders.

Captain R. de Solderhoff, Resident Medical Officer, St. George's Hospital, Bombay, reverted to military duty. He was relieved of his civil duties on the forenoon of 10th July, 1941.

#### INDIAN LAND FORCES

##### *(Emergency Commissions)*

The undermentioned Captains (on probation) are confirmed in their rank, with effect from the dates specified:—

V. Sivasankaran. Dated 22nd June, 1940.

K. N. Rao. Dated 1st July, 1940.

R. Kasliwal. Dated 23rd September, 1940.

S. D. Dalal. Dated 23rd September, 1940.

A. S. Rao. Dated 10th October, 1940.

M. N. Rajan. Dated 15th October, 1940.  
 S. N. Kaul. Dated 15th November, 1940.  
 K. L. Jetley. Dated 2nd December, 1940.  
 C. V. Krishnaswami. Dated 2nd December, 1940.  
 I. H. B. Ghosh. Dated 5th December, 1940.  
 C. L. Bhola. Dated 15th January, 1941.

The undermentioned Lieutenants (on probation) are confirmed in their rank, with effect from the dates specified:—

10th June, 1940	V. T. Kuriyan.
H. L. Bhatia.	S. P. Dutt.
13th June, 1940	V. R. Kamath.
M. S. Boparai.	M. B. Hasan.
T. R. Bargotra.	B. S. Saxena.
V. Parkash.	N. V. Gharpure.
14th June, 1940	K. Banerjee.
S. M. Shafi.	L. S. Nathan.
M. Ali.	T. T. Ramalingam.
1st July, 1940	P. K. Chatterjea.
S. S. Sekhon.	A. K. Jadeja.
15th July, 1940	M. R. Vachha.
G. Singh.	A. N. Ramanathan.
M. Singh.	R. C. D. Tarapore.
1st August, 1940	M. V. Sarma.
D. P. Puri.	A. K. Barat.
N. A. Kuraishy.	B. B. Mandal.
15th August, 1940	K. K. Seal.
I. A. Sahibzada.	M. V. Krishnamurthy.
1st September, 1940	I. R. Rao.
M. H. Ahmed.	S. Rodrigues.
15th October, 1940	S. C. Roy.
B. L. Raina.	S. C. Ghosh.
A. Bhattacharjee.	H. C. Mediratta.
B. B. Sen Gupta.	R. R. Reddi.
K. B. Sen.	S. M. V. Menon.
D. K. Ghoshal.	F. M. Koland.
H. Sen Gupta.	C. Bhadrachari.
B. M. Sinha.	M. M. Hossain.
S. K. Ghose.	V. R. M. Sadasivan.
S. N. Sinha.	L. Verghese.
C. K. Kesavan.	S. Ghose.
C. S. Krishna Murthi.	S. Kaul.
S. K. Choudhury.	M. Ramzan.
K. C. Hazra.	S. A. Choudhuri.
M. P. Sarma.	16th October, 1940
P. C. Koshy.	T. Anjaneyulu.
S. K. Ray.	1st November, 1940
G. Sambasivan.	J. P. Zachariah.
K. K. Nayak.	P. P. Singh.
P. A. Paul.	S. B. Singh.
V. Rangachari.	S. Prakash.
P. B. Menon.	B. L. Malhotra.
A. S. L. Narasimham.	N. C. V. Raman.
S. A. R. Iyengar.	R. V. R. Rao.
1st November, 1940	S. Banerjee.
A. G. J. P. Fernandes.	D. S. Patkar.
M. Aslam.	M. S. Menon.
G. M. Das.	P. K. Nayak.
D. S. Shukla.	K. M. Rao.
K. L. Gupta.	M. B. Nair.
K. A. Malik.	K. Bhaskaran.
V. L. Parthasarathy.	B. C. Karmaker.
K. L. Datta.	K. Parthasarathy.
2nd November, 1940	C. Joseph.
B. Mukerji.	A. I. Lakshminarayanan.
15th November, 1940	P. V. Venkatachalam.
M. J. Ahmadi.	K. Mariswamappa.
N. Ahmad.	V. S. Iyer.
M. S. Khan.	P. K. Antony.
A. S. Gharjakhia.	O. C. Mathur.
P. N. Bose.	A. G. Siddiqui.
R. A. Riyaz.	M. Ibrahim.
A. H. Hamid.	J. M. Sinha.
P. N. R. Setty.	16th November, 1940
N. Rangavadivelu.	J. Ramakrishnayya.
M. G. Nayan.	A. B. Roy.
D. R. Vaidya.	M. G. Pendharker.
S. B. Lal.	18th November, 1940
N. K. Roy.	B. M. Ambady.
S. N. Mukerji.	T. R. A. Vaidya Nath.
S. H. R. Shahid.	

2nd December, 1940

H. K. Khalil.  
 P. F. D'Souza.  
 P. K. Kar.  
 U. Mazumder.  
 B. B. Biswas.  
 M. K. Siddiqui.  
 E. J. Ramdas.  
 J. H. Joshi.  
 G. B. Godbole.  
 Y. K. C. Pandit.  
 K. S. B. Menon.  
 A. K. Bose.  
 T. P. I. Sundaram.  
 V. V. Narayanamurti.  
 S. V. Ghurye.  
 V. D. Shah.  
 S. S. Kirtane.  
 H. P. B. Neku.

V. G. Pande.  
 Bimanesh Bhusan Chatterjee.  
 G. S. R. Reddy.  
 P. P. G. Tampi.  
 F. B. Laher.  
 Bibhuti Bhusan Chatterjee.  
 N. I. Subrahmanyam.  
 C. A. Rajamani.  
 S. A. Qadir.  
 M. N. Sen.  
 S. V. Garde.  
 N. G. Ajgaonkar.  
 N. G. A. S. Raghavan.  
 J. G. Rodrigues.

3rd December, 1940

S. D. Malaviya.  
 N. T. Ghaisas.

#### Emergency Commissions

The undermentioned appointments are made:—

#### To be Lieutenants

27th February, 1941

Colin Ibbotson.

Ronald Michael Vanreene.

The following appointments are made:—

#### INDIAN LAND FORCES

#### (Emergency Commissions)

#### To be Lieutenant (on probation)

Balkrishna Kesheo Sheorey. Dated 23rd June, 1941.

#### PROMOTIONS

#### Lieutenant-Colonels to be Colonels

W. C. Spackman. Dated 11th June, 1941, with seniority from 26th January, 1936.

M. L. Treston. Dated 1st June, 1941, with seniority from 1st February, 1937.

#### Captain to be Major

D. K. L. Lindsay. Dated 1st August, 1941.

#### Captain to be Brevet-Major

V. A. Edge (retired officer re-employed). Dated 3rd September, 1939.

Note.—The promotion of Major B. S. Nat to his present rank is antedated to 20th November, 1934.

#### INDIAN LAND FORCES

#### (Emergency Commissions)

#### Lieutenants to be Captains

10th June, 1941

H. L. Bhatia.

13th June, 1941

M. S. Boparai.

T. R. Bargotra.

V. Parkash.

14th June, 1941

S. M. Shafi.

M. Ali.

1st July, 1941

S. S. Sekhon.

15th July, 1941

G. Singh.  
 M. Singh.  
 A. L. Som.  
 A. R. Tampi.  
 R. Subramanian.  
 A. P. Ray.  
 M. R. Tatwawadi.  
 R. K. Chakravarty.  
 R. Ghose.  
 G. C. Sarkar.  
 M. Imaduddin.  
 G. V. Chaphekar.  
 B. L. Somway.  
 S. D. Butt.  
 P. P. M. Nair.

G. V. Munje.  
 K. S. Seth.  
 H. D. Varma.  
 B. B. Choksi.  
 S. C. P. Sinha.  
 M. S. R. Rao.  
 N. C. Mukherjee.  
 A. Mohiuddin.  
 N. K. Nag.  
 A. A. Khan.  
 E. G. Sastry.  
 M. Iahli.  
 S. K. Das.  
 S. C. Bagchi.  
 D. N. Rai.

S. M. De.	A. K. Sen Gupta.
K. M. Rowther.	A. C. Ray.
H. P. Banerji.	M. V. Nayar.
A. B. Talibuddin.	S. Ramalingam.
S. B. Rabbi.	K. L. Chhitwal.
P. Dutt.	N. C. Bhowal.
R. L. Mehta.	T. S. Ramamurti.
M. N. Khan.	S. V. Dalvi.
M. R. Rao.	P. V. Ramaniah.
A. K. Mallik.	K. John.
M. Y. Alurkar.	B. Raghavendracher.
S. K. Sen.	S. D. N. Sinha.
S. N. Narula.	A. K. Das Gupta.
B. Ghosh.	G. A. Sundaram.
A. C. Bhatara.	R. S. Rao.
M. Singh.	K. P. Roy Chowdhuri.
N. K. Mehra.	M. K. K. Menon.
T. S. Parmar.	D. S. Kaicker.
K. K. Das.	B. N. Mukherji.
F. C. Das.	N. N. Santhanam.
T. Titus.	M. M. R. V. A. Nambiyar.
S. K. Bhaumik.	S. Singh.

2nd July, 1941

O. Prakash. N. Sen Gupta.

3rd July, 1941

A. K. M. Mazhar.

4th July, 1941

M. N. Shrinagesh. H. A. S. Joseph.

5th July, 1941

R. B. Sule.

16th July, 1941

A. K. Mukerji. M. K. Maitra.

S. K. Bose.

17th July, 1941

A. K. Das.

18th July, 1941

E. R. F. Rebello. K. P. Joseph.

S. D. Basu. M. A. Paul.

## REVERSION

The undermentioned, at their own request, revert to the rank stated whilst employed during the present emergency:—

## As Majors

Lieutenant-Colonel A. N. Dickson, M.C., I.M.S. (Retd.). Dated 25th February, 1941.

Lieutenant-Colonel M. R. C. McWatters, I.M.S. (Retd.). Dated 3rd March, 1941.

## RETIREMENTS

Lieutenant-Colonel W. C. McKee, on account of ill-health. Dated 21st March, 1941.

Lieutenant-Colonel S. N. Makand. Dated 10th July, 1941.

## Notes

## CIPLA PRODUCTS

THE enterprising Bombay firm of drug manufacturers, Chemical, Industrial and Pharmaceutical Laboratories Limited, have just issued their *Therapeutic Index*. To quote from their foreword:—

'In presenting the new 1941 edition of our *Therapeutic Index* we hope to serve the medical profession by giving very useful details of various clinical applications of our products.

We are now entering the fifth year of manufacture of pharmaceutical products and the name CIPLA has been well established not only all over India but even

in many foreign countries, where our medicines are in constant demand.

All our products are manufactured under strict chemical, biological and clinical control and each batch is carefully tested before being put on the market.

The various preparations are arranged in alphabetical order and the composition, indication, dosage, technique of administration and packing are described under each head. The space in such a concise booklet does not permit to furnish detailed information regarding each product. Full literature on each product and any other information will be gladly supplied on request.

The booklet contains a long list of pharmaceuticals which will almost completely supply the requirements of the average practitioner.

We notice in particular their Nicosil which is a sulphonamide preparation combined with nicotinic acid. This indicates how well abreast of recent advances the firm have kept themselves, for it is only within a short time that the observation regarding the detoxicating effect of nicotinic acid was made.

This booklet can be obtained from Messrs. Chemical, Industrial and Pharmaceutical Laboratories Limited, 289, Bellasis Road, Byculla, Bombay.

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## Original Articles

### EXTRA-PLEURAL PNEUMOTHORAX—ITS SCOPE AND LIMITATIONS

By P. V. BENJAMIN, M.B., B.S. (Madras),  
T.D.D. (Wales)

*Medical Superintendent, Union Mission Tuberculosis Sanatorium, Arogyavaram, near Madanapalle*

EXTRA-PLEURAL pneumothorax is one of the more recent methods of collapse therapy in pulmonary tuberculosis. Though this method has been suggested and tried after Tuffier introduced the 'extra-pleural pneumolysis' operation in 1913, it was abandoned after a short trial. In 1934 Baer and Graff returned to it as did others, but it is only since 1937 that it has come to be extensively used. However, since the experience of the operation covers only a short period of five years, any conclusions about it should still be considered tentative and possibly subject to revision in the light of further experience, but enough work has been done to give a preliminary opinion about its scope and limitations.

The extra-pleural pneumothorax operation is similar to extra-pleural pneumolysis except that the space formed between the parietal pleura and the thoracic wall is filled with air instead of fat, muscle or paraffin.

#### *The technique of the operation*

The operation is usually done under local anaesthesia; a general anaesthetic can be given but we have never found this necessary.

The patient is placed in the lateral position as for a thoracoplasty, and the arm on the side to be operated on is pulled forward so that the vertebral border of the scapula comes to lie on or parallel to the fourth rib. An oblique incision 5 to 6 inches long is made in the line of the fourth or fifth rib. After severing the fascia and muscle the rib is cleaned and 4 to 5 inches of it resected subperiosteally. By blunt dissection with a flat thin spatula a cleavage can be made between the intercostal muscles to the endothoracic space under the rib, above and below. If there are no adhesions it is fairly easy to get access to this space by gentle manipulation with the gloved finger and it can little by little be enlarged; as the stripping goes further in beyond the reach of the fingers, swabs can be used to separate the pleura from the chest wall and the apex also can be released from the dome of the chest.

But unfortunately there are often adhesions which may vary from thin adhesions covering small areas to very thick fibrous adhesions extending over a large area and penetrating deeper than the pleura into the chest wall. It is dangerous to attempt to break extensive adhesions as it may tear the lung, but more frequently it will lead to severe bleeding. Small areas of fresh adhesion can be separated by

gentle and careful manipulation. This procedure may be described as 'wiping the lung away from the chest wall'.

When a sufficient area of the lung has been stripped and the necessary space created, the space is wiped dry of blood. There is always some oozing of blood, but, if no adhesions have been broken, the bleeding is slight and easily controlled. If adhesions have been broken, the bleeding will be more profuse and has to be controlled by pressure. Sometimes electro-coagulation of the bleeding points may be necessary. But before closing the wound it must be made certain that all the bleeding has been controlled.

In the later operations of our series we have at this stage filled the space with warm normal saline before closing the wound. It probably helps to control the oozing of blood, a certain amount of which is bound to take place into the extra-pleural space for some time after the operation. But more important is the case with which the effused blood can be aspirated in post-operative care.

The wound is closed in three layers, the deep layer by interrupted catgut sutures, including the periosteum of the two adjacent ribs and the intercostal muscles, the second layer by continuous catgut suture including muscles and fascia, and the third layer, the skin, by silkworm gut. No drainage tube should be introduced.

Air is then injected into the space, between 100 c.cm. and 400 c.cm., according to the space and the pressure; the closing pressure should be a low positive between +2 and +10.

#### *Post-operative care*

The success of extra-pleural pneumothorax depends mainly on careful post-operative care. The patient has to be examined frequently by the fluoroscope to note the amount of collapse and the presence of fluid. Our procedure is to take an x-ray film immediately after the operation to find out the extent of the space created and the nature of the collapse of the lung. Twenty-four hours later the patient is screened, and if there is found any effusion of blood it is aspirated and a refill of air is given at the same time. During the first week the patient is screened at least every other day and refills of air are given as required according to the condition of collapse noted on screening. Usually two or three aspirations are needed during the first week after the operation, then refills once a week during the first month. After that if everything goes well the intervals can be still further increased.

Aspiration of effusion in the first week is essential, otherwise the fluid is likely to leak through the deeper layers and escape into the tissues under the skin; also it may leak through the wound, soak the dressings, and lead to infection and later to sinus formation. Also, if aspiration is not done and refills are not given at the proper time, the extra-pleural space may get

obliterated; the effused blood gets organized and drags out the lung to the chest wall and so the effect of the operation is spoilt.

### Complications

*Shock* produced by the operation is surprisingly little, much less than ordinarily seen in a thoracoplasty operation. We have operated on some very weak patients who would have been considered very poor risks for a major operation and they have all stood the operation without any severe shock.

*Bleeding* is the most common and serious complication. As mentioned above there is bound to be some oozing of blood, but, unless adhesions have been broken, it is mild and easily controlled. It is more serious if adhesions have been broken, depending on the extent of the adhesions. In one case in our series in which one thick adhesion was broken, bleeding at the time of the operation was controlled, but a secondary hæmorrhage took place twenty-four hours later and in spite of blood transfusions the patient did not recover from the effects of it and died forty-eight hours after the operation. Learning by experience we do not now attempt an extra-pleural pneumothorax if the x-ray picture suggests there are likely to be extensive adhesions.

*The tearing open of cavities* is a danger, especially if manipulation is not gentle and there are thin-walled superficial cavities. So far we have not had this complication.

*Subcutaneous emphysema* sometimes occurs. If the suturing is done properly this is not usually extensive or serious. Sub-fascial emphysema and air embolism are mentioned as possible complications, but so far we have not experienced them.

*Infection* of the extra-pleural space occurs in some cases. In a few this is a tuberculous infection from the pleural surface and it has been possible to find tubercle bacilli in the extra-pleural fluid. When frequent aspirations of blood have to be done it may happen occasionally that even with the utmost care infection takes place. Infection from the skin through leakage of effusion has already been mentioned. Proper aseptic precautions during aspiration and dressing will prevent most infections. If infection does take place, it can usually be controlled by aspiration and washing out, but sometimes the space may have to be opened and drained. This may lead to a persistent sinus which may later require a thoracoplasty.

### Indications for extra-pleural pneumothorax

Where collapse therapy is indicated in pulmonary tuberculosis it is generally recognized that intra-pleural artificial pneumothorax is the best procedure. Therefore extra-pleural pneumothorax is only indicated when intra-pleural pneumothorax has failed either completely or partially. Thus the indications for the extra-pleural operation are the same as for artificial

pneumothorax with the reservation that the latter can be tried in very weak patients in whom extra-pleural pneumothorax, being a major operation, is contra-indicated.

'Extra-pleural pneumolysis' and extra-pleural pneumothorax have usually been advocated for patients in whom artificial pneumothorax has failed but in whom thoracoplasty is contra-indicated because of contralateral disease or because of the general debility of the patient. But this general indication does not now hold good as the indications for thoracoplasty are not now so restricted as they were some years ago. Bilateral disease is no longer considered an absolute contra-indication for thoracoplasty when it is done in small stages and when the principle of selective collapse is carried out. We have had several cases in which resection of the seven upper ribs has been done with good results, while artificial pneumothorax has been carried on simultaneously for active disease in the contralateral lung. Hence unsuitability for thoracoplasty cannot now be taken as an indication for choosing extra-pleural pneumothorax. In practice, it is generally found that when a patient is not suitable for thoracoplasty according to the modern technique mentioned, he is not suitable for extra-pleural pneumothorax. Therefore when the patient is suitable for major surgery the question is whether thoracoplasty or extra-pleural pneumothorax is to be preferred in that particular case.

Thoracoplasty is an operation which collapses the lung permanently. If the lung in the area to be collapsed is extensively affected with chronic fibrosing disease with one or more cavities and there is little chance of this part of the lung functioning at any time, the best procedure will be to collapse the lung permanently by a thoracoplasty. But frequently there are cases with soft-walled cavities in the sub- or infra-clavicular region, surrounded by some infiltration and a good deal of healthy lung. To collapse such cavities by a thoracoplasty would usually mean a six or seven rib resection which would put out of action permanently a good portion of healthy lung also. Therefore in such cases, on the basis of our experience in artificial pneumothorax treatment, where, after one or two years when the cavities have healed, the lung can be allowed to expand and function normally, it is reasonable to prefer extra-pleural pneumothorax to thoracoplasty.

Extra-pleural pneumothorax is also preferable in cases where there are extensive scattered infiltrations in one lung with patches of healthy lung intervening; there may be a cavity in the sub-clavicular region. In such cases a partial thoracoplasty is not likely to be effective enough and a complete thoracoplasty is too drastic.

In cases where there is a thin-walled superficial cavity, a thoracoplasty is usually to be preferred, because there is the possibility of extensive adhesions and also the danger of tearing open the cavity during the operation.

An extra-pleural pneumothorax is generally to be preferred in young people during the growing stage as a thoracoplasty is likely to interfere with the growth and shape of the thorax and cause deformity.

Cases with rapidly spreading disease, especially bi-lateral, are not suitable for extra-pleural pneumothorax or any major surgery.

#### *Combined intra- and extra-pleural pneumothorax*

It has been suggested that an extra-pleural pneumothorax should be done to make the collapse effective in artificial pneumothorax cases where uncauterizable adhesions cause an ineffective pneumothorax. An extra-pleural pneumothorax can be done over the area where the lung is adherent, and the extra-pleural space can be connected with the intra-pleural cavity. We have tried this in three cases but in all there was a severe reaction with effusion in the pleural cavity which required frequent aspirations; two of them became infected and later required a thoracoplasty, while the third had a stormy post-operative course with high temperature but did eventually get better after frequent aspirations and washing out of the pleural cavity. Therefore on the basis of this experience we cannot advocate this procedure generally.

#### *Oil-filling in extra-pleural pneumothorax*

In some cases of extra-pleural pneumothorax there is a tendency for the space to become obliterated in spite of aspiration of fluid and correct filling with air. This can be prevented by filling the space with oil (gomenol 10 per cent in paraffin oil). This is also useful when it is necessary for patients to leave the sanatorium and collapse should still be maintained. Experience with artificial pneumothorax has shown that for complete healing cavities need to be collapsed usually for two to three years. At present it is difficult for many patients with extra-pleural pneumothorax to continue the air filling outside the institution and therefore before they are discharged the space can be filled with oil in order to maintain the collapse. Of five cases discharged with this we have been able to observe three later and all were doing well without trouble.

What happens to the space, after it has been filled with oil for some time, has been seen in two cases in which a thoracoplasty was done later. The space has shown a thick capsule and it would have been unlikely that the lung could have expanded again and therefore probably a permanent collapse had been produced. In extra-pleural pneumolysis when a paraffin wax filling was employed, it was frequently found that some of the wax worked its way out from the space. Whether this will ultimately happen with the oil-filling is not yet known, but so far we have not observed it.

#### *Review of cases*

Since 1938, thirty-nine patients have had an extra-pleural pneumothorax in this sanatorium. In 5 patients after the operation had been begun it was found impossible to complete it because of extensive adhesions; in 3 of these the operation was immediately converted into a thoracoplasty, another had a thoracoplasty subsequently and the fifth is waiting for a thoracoplasty. Five patients are still under treatment of whom 3 have already shown definite improvement. This leaves 29 patients who can be considered in detail.

Of these 29 patients, 6 had a thoracoplasty later, 3 of them because the extra-pleural space became obliterated and 3 to close an empyema space.

Of the remaining 23 patients who had only an extra-pleural pneumothorax, 12 were discharged as 'much improved' and 3 as 'improved'; 8 obtained no improvement; 13 of the 23 became 'sputum negative'.

Of the 29 patients, 21 could have been selected for thoracoplasty but extra-pleural pneumothorax was preferred for various reasons given earlier in this paper. Of the 21 patients 2 had extra-pleural pneumothorax followed by thoracoplasty. Of the remaining 19 patients 15 gained improvement and 12 became bacilli free. Of the remaining 8 patients who were considered at the time unsuitable for thoracoplasty, only 2 gained some but not marked improvement and only 1 became bacilli free.

As regards complications in this series of 29 patients, one patient died of secondary hæmorrhage 48 hours after the operation; one patient died four days after the operation, post-mortem examination showing a marked pleural effusion in the lower part of the pleural space which had had an artificial pneumothorax and which was thought to have been obliterated. This patient had also fairly extensive affection in the contralateral lung which had not been controlled by artificial pneumothorax and for which a thoracoplasty was in view. Death was due to pressure of the effusion on the heart.

In 8 patients there was a subsequent infection of the extra-pleural space. In 5 of these it was controlled by aspiration and washing out and in 3 a thoracoplasty was done later.

#### *Conclusion*

In extra-pleural pneumothorax we have a useful addition to collapse therapy with results in properly selected cases comparable to those of thoracoplasty. It produces far less shock than thoracoplasty, is less deforming, and is a less permanent operation, that is, air filling can be stopped if necessary and advisable, and the lung can be allowed to expand.

There has to be a careful selection of patients for the operation and even then it may not be suitable as adhesions may be found which will make it impossible.



While the best results are seen in patients who could be chosen for either extra-pleural pneumothorax or thoracoplasty, there are certain indications why one should be preferred to the other in a particular individual, and extra-pleural pneumothorax cannot be regarded as a substitute for thoracoplasty.

Finally it must be emphasized that the success of the operation depends on post-operative care. For this a well-trained staff is needed and facilities for frequent x-ray control. Without the trained staff and without the x-ray facilities the operation should not be attempted.

#### *Summary of case reports*

*Case 1.*—Male, aged 25 years, admitted on 25th January, 1939.

*Right side.*—Artificial pneumothorax attempted on 31st January.

No air could be given.

Two courses of sanocrysin—ending on 12th July.

Extra-pleural pneumothorax on 22nd August. Five inches of the 5th rib resected; 5 refills were given.

As the lung showed a tendency to re-expand in spite of refills, oleothorax was started and the extra-pleural space was filled with oil in small doses; the total quantity of the oil introduced was 500 c.cm.

The patient had been TB-positive since admission and at the time of operation, but was TB-negative one month after operation and remained so till the time of discharge.

Culture of the sputum done twice on 8th May and 20th August, 1940, was negative.

Discharged on 20th October, 1940, as 'much improved'.

Came for re-examination in February 1941. Oil was still present in the extra-pleural space; TB-negative. Keeping good health.

*Figure 1, plate XXXII.*—Before operation. Note cavity right sub-clavicular region. Scattered infiltration right lung.

*Figure 2.*—Extra-pleural pneumothorax right side, with slight effusion.

*Figure 3.*—Right lung beginning to expand but controlled by oleothorax.

*Case 2.*—Female aged 23 years, admitted on 18th July, 1939.

Artificial pneumothorax attempted on right side on 22nd July. No air could be given.

One course of sanocrysin ending 18th October. Extra-pleural pneumothorax on 26th October. (Five inches of the 4th rib resected.)

Eleven extra-pleural pneumothorax refills given.

As the lung showed a tendency to re-expand in spite of refills, oleothorax was started and the extra-pleural space was gradually filled with oil. Total oil introduced was 480 c.cm.

Sputum was TB-positive since admission and at the time of operation, but became negative after the commencement of extra-pleural pneumothorax and remained negative till the

time of discharge. Cultures of the sputum done twice on 5th July and 22nd August, 1941, were negative.

Discharged on 17th October, 1940, as 'much improved'.

*Figure 4.*—Extensive mottling right lung with a cavity at the level of the 2nd rib anteriorly, and 6th rib posteriorly. (Not easily seen in the print.)

*Figure 5.*—Soon after extra-pleural pneumothorax right side.

*Figure 6.*—Some time before discharge. Lung beginning to get expanded, but controlled by oleothorax.

*Case 3.*—Female, aged 16 years, admitted on 25th July, 1939.

Artificial pneumothorax left side attempted on 28th July. No air could be given.

One course of sanocrysin ending on 4th October.

Sputum positive for TB since admission and at the time of operation.

Extra-pleural pneumothorax done on 30th October. (Five inches of the 4th rib resected.)

Eighteen extra-pleural pneumothorax refills were given; oleothorax started on 16th April, 1940.

After oleothorax, effusion in the extra-pleural space appeared. Hence aspiration of fluid and replacement with air done. In the end, 310 c.cm. of oil introduced.

Discharged 8th March, 1941, as 'much improved'.

Sputum became negative 4 months after the operation and remained so till the time of discharge.

Cultures of sputum done twice on 13th September, 1940, and 21st January, 1941, were negative.

*Figure 7, plate XXXIII.*—Note extensive involvement of the left lung with signs of breaking down middle zone.

*Figure 8.*—Extra-pleural pneumothorax left side. Practically complete collapse of the lung.

*Figure 9.*—Extra-pleural space partially filled with fluid and oil.

*Case 4.*—Female, aged 35 years, admitted on 16th October, 1940.

Artificial pneumothorax left side attempted on 25th October. No air could be given.

Extra-pleural pneumothorax done on 5th November. (Four inches of the 5th rib resected.)

Twelve extra-pleural pneumothorax refills were given.

Preliminary to discharge oleothorax started in the extra-pleural space. 210 c.cm. of oil introduced.

Discharged on 28th May, 1941, as 'much improved'.

Sputum was TB-positive at the time of the operation, but was negative one month after operation and remained so till the time of discharge.

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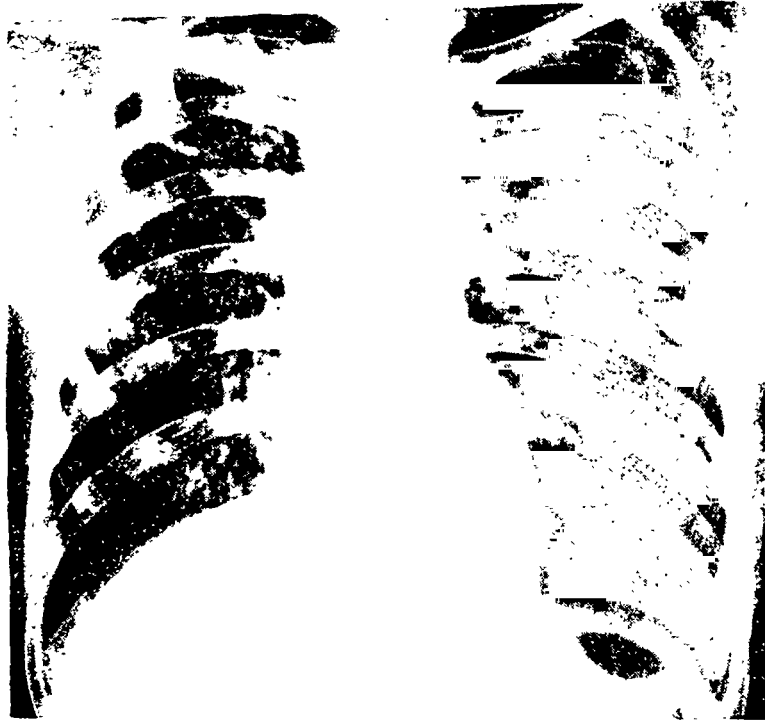


Fig. 1. *Case 1.*



Fig. 2. *Case 1.*



Fig. 3. *Case 1.*



Fig. 4. *Case 2.*



Fig. 5. *Case 2.*



Fig. 6. *Case 2.*



7. Case 3.



Fig. 8. Case 3.



9. Case 3.

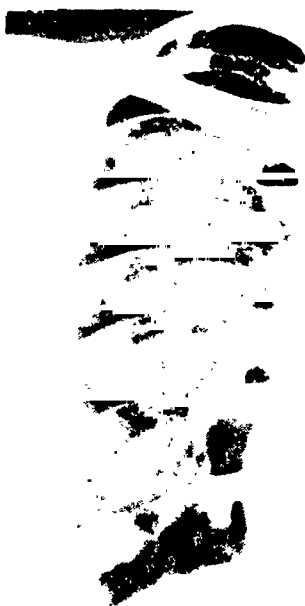


Fig. 10. Case 4.



# TRANSILLUMINATION AND SIMULTANEOUS CAUTERIZATION OF PLEURAL ADHESIONS

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and

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IN endopleural pneumolysis (operation of Jacobaeus), the preceding pleuroscopic examination is of utmost importance. After the general inspection of the pleural cavity and its topographical conditions, the attention of the operator is drawn to the pleural adhesions proper. In order to determine the feasibility of cauterization, three factors should be examined very carefully, *viz*, the position of the adhesions, their shape and as far as possible their anatomical structure.

Generally the operator succeeds rather easily to get the exact view of the position and the shape of the adhesions (dimension, direction and correlation with surrounding organs). There remains, however, the third factor to be investigated, *viz*, the anatomical condition of the adhesions. This is as important as their position and shape, because of the danger of falling upon the vascular tissue or the penetrating parenchymatous tissue of the lung. There may be some adhesions, the internal structure of which may be guessed from their shape. Most of them, however, do not reveal their anatomical secret to our inspection, however careful it is.

During the last few years, progressive pleuroscopic technique has brought forward a valuable improvement, *i.e.*, the *transillumination* of adhesions. Various models of diaphanes have been recommended for this purpose by Bethune (1933), Graf, Heine (1930), and Maurer (1928, 1930). The general procedure is as follows: under the guidance of the pleuroscope, the diaphane is introduced through the second opening (destined for the cautery) and directed behind the adhesion which is to be dealt with. If the pleuroscope and the diaphane are brought into an optimal position on the opposite sides of the adhesion, we observe a more or less distinct transparency of the strand according to its thickness and extent. This transparency is also more or less modified by the presence of vessels or pulmonary tissue, the latter showing always some cicatricial densification at the proximity

of adhesions. In spite of the incontestable utility of such diaphanes they have, however, some inconveniences in their use.

(1) It is impossible to use a common plug for the electric lamp of the pleuroscope and for the diaphane because of the risk of electric shocks.

(2) It is impossible to introduce the pleuroscope, the cautery and the diaphane at the same time, even by making a third aperture, because the operator would be unable to handle simultaneously three instruments. Hence, the operator has to retain in his memory the fleeting impression of the transilluminated spot as soon as he replaces the diaphane by the cautery. If he wants to check the condition after cauterizing for some time, he is compelled to remove the cautery for reintroduction of the light, which means always a loss of valuable time particularly in cases with complicated orientation.

The first inconvenience mentioned might be easily overcome by using separate plugs for the cautery and the light.

The second inconvenience, however, should be obviated by finding a particular device attached either to the pleuroscope itself or to the cautery, as the use of a third instrument is impracticable. Rappe suggested a cautery with the connection of a lamp. This model is, however, hardly practicable for the following reasons. Firstly, it would be difficult to obtain the optimal illumination by the lamp and the optimal position of the cautery at the same time because of the fixed coupling. Any movement intended either for the lamp or for the cautery involves some displacement of the connected part. Moreover, it would be impossible to follow one of the most important rules in adhesion cutting, *i.e.*, never to lose sight of the point of the cautery during the very act of burning. The operator would be always troubled by the light which cannot be directed behind the adhesion unless the point of the cautery would disappear as well.

On the other hand, the following lines will show that the pleuroscope itself and its lamp are able under certain conditions to produce the diaphanous effect.

Before entering into any discussion about various pleuroscopic models we should like to stress some facts of optical conditions. If we want to obtain an optimal effect of transillumination, the light should fall upon the reverse side of the adhesion which lies in front of our view. It goes without saying that no pleuroscope can be contrived for this ideal purpose. The transillumination of the object may still be obtained, if the source of light is deviated from the opposite point of the visual axis, as far as the rays fall upon the visual field in a more or less obtuse angle. The limit of transillumination is reached, if the light and the view meet the object at the right angle. Naturally the force of transillumination decreases gradually the more the rays deviate from the

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Cultures of sputum taken on 22nd January and 6th May, 1941, were negative.

Figure 10.—Infiltration left upper and middle zone with a small cavity in the left claviclar region. (Not quite obvious in the print but clear in the film and confirmed by fluoroscopic examinations.)

Figure 11.—Extra-pleural pneumothorax on the left side with selective collapse.

opposite point of view towards the right angle. Beyond the right-angular crossing of the rays and the visual field, no transillumination can be obtained because of the increasing direct illumination of the object. Consequently, in order to contrive a pleuroscope which can give the required transillumination, the adjustment of the visual field and the lamp should fulfil two conditions.

(1) The rays of the light should cross the visual field at an obtuse angle.

(2) The distance between the focus of the light and that of the optical lens should be sufficiently large to allow a suitable approach to the adhesion between them.

The question arises therefore whether any pleuroscopic model exists which could fulfil these conditions. We mention below some of the most common instruments having various angles of view with respect to the main axis.

- |     |             |          |                              |
|-----|-------------|----------|------------------------------|
| (a) | View of 90° | model of | Jacobaeus-Unverricht.        |
| (b) | " " 120°    | " "      | Maendl and Kornitzer (1927). |
| (c) | " " 135°    | " "      | Kalk (1929), Graf.           |
| (d) | " " 150°    | " "      | Chandler (1930).             |
| (e) | " " 155°    | " "      | Davidson (1929).             |
| (f) | " " 180°    | " "      | Kremer.                      |

The following illustrations demonstrate the above-described optical conditions, especially the rays of the lamp crossing the visual field of the optical system.

Figure 1 shows the adjustment of the model (a), i.e., Jacobaeus-Unverricht (view 90°, visual

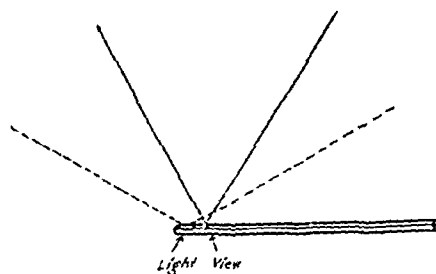


Fig. 1.

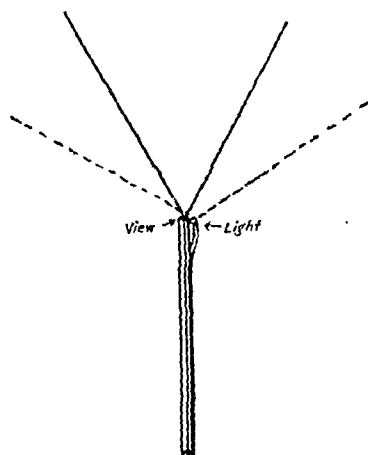


Fig. 2.

field 60°, luminous field about 120°). Out of all the rays which are crossing the visual field

only an extremely small portion forms an obtuse angle and hence the device is impracticable.

Figure 2 demonstrates the condition of the model (f) of Kremer (view 180° = axial view). The axis of the optical system goes parallel with the central ray of the light, and so no diaphanous effect can be obtained.

Figure 3 shows the condition of the model (c) of Kalk, the visual axis of which lies in the middle between the two extremes of (a) and

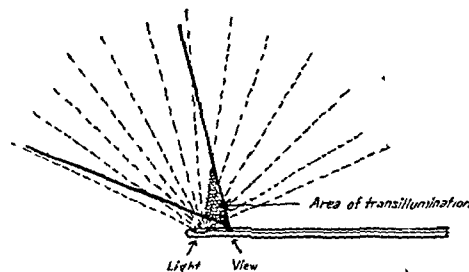


Fig. 3.

(f), i.e., an oblique view of 135° (visual field 58°, luminous field about 132°). Almost all rays are traversing the visual field, a certain part of them crossing in an obtuse angle, forming quite a large area in which transillumination of the diaphanous object results.

None of the other above-mentioned models with oblique view gives sufficiently similar adjustment of view and light compared with Kalk's pleuroscope.

Any operator who is experienced in pleuroscopy will realize at once the advantage of simultaneous diaphanoscopy of adhesions when using the model of Kalk (1935). By approaching the adhesion with the pleuroscope, as if going to touch it, a sudden transillumination results. The more the instrument is directed in a perpendicular sense towards the longitudinal axis of the adhesion the better will be the diaphanous effect. In such a way we are able to localize easily the thinnest part of the adhesion which becomes most transparent and hence suitable for cauterizing. In adhesions which appear like threads, bands, veils or membranes the diaphaneity appears mostly uniform along one to three centimetres. If, however, the adhesion presents a shape like a cone, hour-glass or falx, the translucent zone may become very narrow, up to a few millimetres, situated close to the thoracic wall. This narrow fibroid zone fit for cauterization is only detectable by transillumination. Hence, in cases which do not reveal any such transparency no cauterization in the ordinary way should be risked. In such conditions the intraparietal enucleation of the whole costal pedicle of the adhesion should be tried according to the particular technique recommended by Maurer (1928, 1939).

It is, however, surprising how many large, irregular and complicated adhesions can be dealt with in the ordinary way of cauterization by the help of transillumination. Although they may show a very narrow transparent

ledge, the severing may advance quite smoothly by cleaving small notches into this diaphanous part. Owing to the gradual relaxation of the strand new translucent ledges appear suitable for further cauterization.

In similar cases we observe sometimes an apparently paradoxical phenomenon, *viz*, an increasing transparency of the tissue in spite of the increasing broadening of the adhesion while advancing with the cautery. We find at once the explanation, when we break finally through the most transparent spot and detect a cavitary pocket of the pleura caused by a circular parietal insertion of the adhesion. It would have been impossible by means of ordinary direct illumination to surmise that such an apparently thick and solid adhesion included only a thin-walled hole and was so easy to be cauterized. It goes without saying that the mistake of opening a pulmonary cavity should hardly happen at the hands of an experienced operator in cases similar to the aforesaid conditions.

Generally we choose the third, fourth or fifth intercostal space in the posterior axillary line for the introduction of the pleuroscope, at the second or third intercostal space in the mid-clavicular line, for the cautery. Both openings can be interchanged for either pleuroscope or cautery. In this way we gain not only the best view from either side, but also the greatest chance of meeting the adhesion with both instruments at the right angle for yielding the best conditions for diaphanoscopy and simultaneous cauterization.

The instrumental set (figure 4) comprises three principal parts, the trocar (1), the lamp-carrier (2), and the optical system (3).

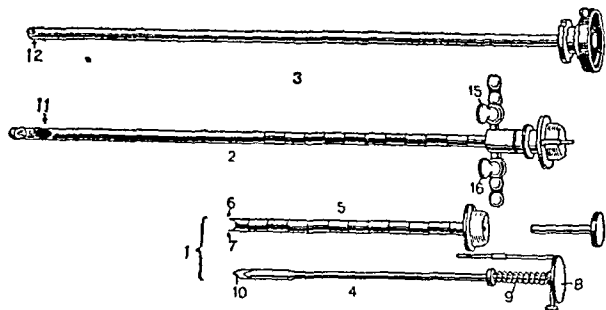


Fig. 4.

The perforator (4) of the trocar has a flat, two-edged lancet-shaped point (10) instead of the usual conical or triangular one. The perforator is held back inside the tube (5) by a spring (9). The point would only protrude by pressing upon the flat top of the perforator, a small disc (8) replacing the ordinary handle. By loosening the pressure the point would retreat automatically into the end (6 and 7) of the tube. This trocar has the great advantage of allowing quite a smooth perforation of the thoracic wall without using much effort. The recoiling point of the perforator lessens the risk of injuring the lung.

The lamp-carrier (2) has the shape of a tube intended for the introduction of the optical system (3), the lens (12) of which gives free visual field through the opening of the tube (11). The tube of the lamp-carrier serves moreover as an air-conductor (15 and 16) between the pleural cavity and the manometer of the pneumothorax apparatus. The intrathoracic pressure, therefore, is continuously checked and regulated during the operation without interruption as it happens most frequently in devices with combined cautery and air-conductor.

The advantages of the optical system with the oblique view of  $135^\circ$  consist mainly in its optimal adaptation to the topographic conditions of the pleural cavity. The optical picture corresponds to the axial view whatever movement is done (inclination or turning) and there is no phenomenon of reversing as we see in the optical system with a view at right angles. Most of the adhesions can be inspected at least from three sides and small adhesions would reveal their surface from all sides. Briefly we may say that this instrument (with the oblique view of  $135^\circ$ ) gives in an ideal way the twofold advantage of the axial view of Kremer's instrument and the right-angular view of the instrument of Jacobaeus-Unverricht.

A further progress has been achieved by Graf in contriving the pleuroscope of Kalk into an instrument for combined use of optical system and cautery (figure 5). The threefold combination of Graf's model as endoscope, cautery

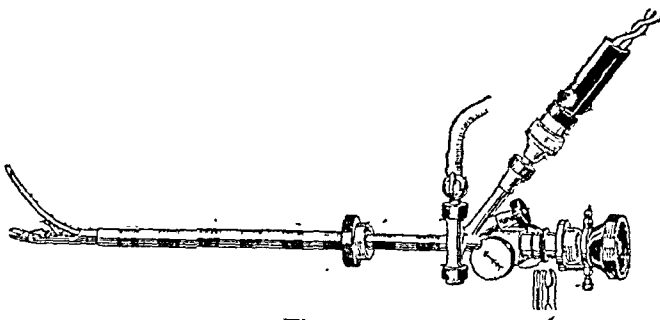


Fig. 5.

and diaphane can be considered as an ideal technical perfection in order to perform endopleural pneumolysis by way of only one incision.

### Conclusion

Experience in more than 200 operations performed with the pleuroscopic models of Kalk and Graf proved the superiority of these instruments to any other model contrived for endopleural pneumolysis. Their main advantage is to allow transillumination of adhesions and simultaneous cauterization. The use of these instruments gives the operator a feeling of safe manipulation by simplifying complicated and doubtful conditions.

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## THORACOSCOPY AND PNEUMOLYSIS IN TUBERCULOSIS

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ARTIFICIAL pneumothorax is, perhaps, the easiest and the most efficient method of collapse therapy in pulmonary tuberculosis. The efficacy of pneumothorax is in direct proportion to the degree to which the diseased portions of the lung can be collapsed. Adhesive pleurisy, depending on its extent, might either completely prevent induction of pneumothorax, or allow only a partial collapse of the lung. According to Alexander (1937), in about 20 per cent of all cases in which it was undertaken, induction of pneumothorax failed, while in 42 per cent the presence of adhesions produced only partial pneumothorax. Any supportive surgical procedure which can transform a partial pneumothorax into a complete one with minimum risk and complications and maximum efficiency must therefore take the highest place of importance in the surgical collapse-therapy programme. Intrapleural pneumolysis under thoracoscopic control is the method of choice.

Jacobaeus of Stockholm in 1913 originated the method of cauterizing adhesions in the pleural cavity through the help of a thoracoscope. By him, and by many others after him, has intrapleural pneumolysis been brought to a high level of effectiveness. The several reports published so far in medical literature testify to its importance and efficacy. Moore in 1934 reviewed the literature and summarized the published reports of 2,043 cases of intrapleural pneumolysis. Matson (1934) reports that among his 249 patients the operation was technically and clinically successful in 152 (61 per cent) patients and that all of these have negative sputum and 83 per cent are working. In 19 patients the operation was technically unsuccessful but clinically successful, all have negative sputum and 68 per cent are working. In 76 patients the operation was both clinically and technically unsuccessful. Jacobaeus (1915) had technical success in 80 per cent of 150

patients and clinical success in 60 per cent. Gravesen (1930) reports that technical success was obtained in 60 of 85 patients (clinically), 25 of the 60 patients were much improved, 29 were merely improved, two became worse and four died. Newton (1940) claims 87 per cent clinical success in 146 patients on whom pneumolysis was performed. In Benjamin's (1939) report on 186 patients, 121 cases are reviewed in detail. Only in 38 could all the adhesions be cauterized. Amongst them he obtained 76.2 per cent positive results. In the 83 patients in whom not all the adhesions were cauterized he reports 73.4 per cent positive results. In my series of 56 cases all adhesions were severed in 34 cases. Technical and clinical successes were obtained in 24 cases giving thereby 70 per cent positive results. Amongst 16 cases in whom not all adhesions were cut 62.4 per cent positive results were obtained. Six cases proved unsuitable for pneumolysis after thoracoscopic examination.

*Indications for thoracoscopy.*—Artificial pneumothorax is a necessary preliminary to thoracoscopy. Apart from its usefulness in cauterizing adhesions in the interpleural space, examination by thoracoscope will enable the diagnosis of other diseases and tumours affecting the pleura and the mediastinum.

*Indications for pneumolysis.*—Closed intrapleural pneumolysis is the operative procedure for making an incomplete pneumothorax complete by the severance of adhesions. The presence of adhesions is not always an indication for cutting them, for bands of adhesions may exist without preventing the necessary relaxation of the lung. Moreover, many adhesions get either naturally severed or get sufficiently stretched as to be innocuous in course of time. Hence ordinarily pneumolysis should not be attempted before three months after induction of pneumothorax. Even such an experienced thoracic surgeon as Alexander considers pneumolysis a difficult and potentially dangerous operation. It should not therefore be employed unless there is definite indication.

A cavity that has not been closed by a partial pneumothorax of sufficient duration constitutes the chief indication for the operation of pneumolysis. Peripheral cavities that hang as it were by adhesions should be freed by cauterization. The operation is indicated also in those non-cavernous lesions which are kept under tension by adhesion particularly in exudative types.

Excessive coughing, pain and hæmoptysis when provoked by pneumothorax refills are occasional indications for pneumolysis.

Acute exudative serous pleurisy and empyema are contra-indications for pneumolysis in the acute stages. But in the later stages of effusion pneumolysis can be attempted after respiration. It should also not be performed in the presence of progressive obliterative pleuritis. No attempt

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at internal pneumolysis should be made when the parietal and the visceral layers of the pleura are intimately adherent and without band formation or when a cone-shaped projection of lung tissue is found extending to the periphery inside the band of adhesion.

Except under exceptionally favourable circumstances cauterization should not be attempted on an adhesion which is less than two centimetres in length.

*Preliminary study of adhesions.*—Radiographic, fluoroscopic and tomographic examination of the adhesions ought to be done in order to understand their location, size, number, direction and extent. Very often many adhesions are missed in radiographs as they are not radio-opaque. The thickness and extent of the adhesions and the presence of lung tissue in them

#### RESULTS OF INTRA-PLEURAL PNEUMOLYSIS

	Number of patients	Percentage	CLINICAL SUCCESS	
			Number	Percentage
All adhesions cut ..	34	60.7	24	70.0
Partially cut ..	16	28.0	10	62.4
Pneumolysis not attempted	6	11.3	..	..
<b>TOTAL ..</b>	<b>56</b>	<b>..</b>	<b>34</b>	<b>60.7</b>

#### TABLE SHOWING SITUATION OF ADHESIONS

Total number of adhesions seen	..	..	243
Upper posterior	..	..	142
Apical	..	..	41
Upper middle	..	..	41
Lower	..	..	41

#### COMPLICATIONS

Number of patients	..	..	56
Hæmorrhage	..	..	2
Serous effusion	..	..	6
Extensive subcutaneous emphysema	..	..	6
Obliterative pleuritis	..	..	1
Spontaneous pneumothorax	..	..	nil
Empyema	..	..	nil

cannot often be accurately judged by radiography. Under these circumstances they can be studied only by direct visualization by thoracoscopy.

*Nature of adhesions.*—More than one adhesion are always found. In my experience 54 is the largest number found in a single patient. Many adhesions are in the form of string-like bands. Sometimes they are like flat tapes. Some are very thick and fleshy. Occasionally fan-shaped adhesions are met with. In one case I had to cut such an adhesion extending from the anterior axillary line to the angle of the ribs behind. The vast majority of the adhesions are found over the upper lobe. Peripherally they are attached mostly to the cupola

of the pleura or in the posterior axillary line or near the angle of the rib. Out of the total number of 243 adhesions seen in all the 56 cases, 142 were in the upper posterior, 41 apical, 41 upper middle and 19 in the lower part of the pleural cavity.

*Pre-operative preparation.*—A refill is to be given the day previous to the operation and the patient is radiographed to localize the adhesion. The chest is prepared as if it is for major surgical procedure to ensure complete asepsis. A quarter grain of morphia and one hundredth grain of atropine is given an hour before the operation. As local anæsthesia is usually chosen, there is no need to starve the patient.

#### Technique

*Choice of instruments.*—There are two types of thoroscopes: one giving direct vision and the other right-angle vision. Whereas the field of vision is limited with the first, practically the whole pleural cavity can be surveyed by the use of the latter by merely rotating the instrument. There are also the single-puncture as well as the double-puncture thoracoscope sets. In the former the thoracoscope and the cautery are introduced by the same cannula, while in the latter they are introduced through separate cannulæ. Some prefer galvano-cautery, while others favour electro-coagulation and cutting by diathermy electrodes. Jacobaeus and Alexander prefer galvano-cautery while Matson and Newton extol the advantages of electro-surgery. I have had experience only of galvano-cautery. I consider that galvano-cautery at dull-red heat will produce sufficient coagulation of the adhesion before cutting through it, so much so that there is very little risk of hæmorrhage, as suggested by the exponents of electro-surgery.

The thoracoscope is introduced through the selected intercostal space, preferably in the anterior axillary line. After a good survey of the pleural cavity and localization of the adhesions the cautery is introduced through the most convenient spot on the chest depending on the situation and direction of the adhesions. Long thin bands can easily be cut a little away from their attachment to the chest wall. The short thick ones have actually to be released from the chest wall by careful enucleation. This procedure will obviate possible injury to lung tissue which might have been pulled into the adhesion. Sometimes it may not be possible to cut through a broad thick adhesion which might contain lung tissue inside. In such a case a superficial cut may be made all round the adhesion and the remaining uncut portion may be allowed to stretch. It can be tackled at a future date.

*Post-operative care.*—Strict bed rest is ordered and the pulse and respiration noted every hour. Pain and cough ought to be controlled by aspirin and codeine. I usually give

2 c.cm. hæmoplastin as a routine before and after operation. Sulphonamide pills, two *t.d.s.*, also form part of the routine post-operative management. A refill is done the day after the operation.

### Complications

*Hæmorrhage* is perhaps the most dangerous but fortunately is rendered rare by efficient operative technique. I had two cases which developed hæmorrhage, both to an alarming degree. In severe cases, thoracoscopy should be attempted again and the bleeding point cauterized. Open operation is rarely necessary.

*Subcutaneous emphysema* is a very common complication. In most cases it does no harm except some crackling discomfort to the patient. In three cases I found emphysema extending to the face, neck, chest, upper limb and abdomen. In one case owing to delay in refill the lung almost completely expanded and as the patient developed obliterative pleuritis pneumothorax had to be abandoned. In another case, the patient coughed out all the air from the pleural cavity into the cellular tissue causing extensive subcutaneous emphysema; and the result was that an *x*-ray after a subsequent refill showed more adhesions than he ever had before.

*Spontaneous pneumothorax* as a result of inadvertent cutting of lung tissue may occur as a complication.

*Tuberculous empyema* might develop in some cases after pneumolysis. Sepsis and consequent non-specific empyema are avoidable through correct aseptic precautions.

Some of the cases develop serous effusion soon after pneumolysis.

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### EXPLANATION OF PLATE XXXIV

- Fig. 1a.—Note the broad band of adhesion at the apex.
- Fig. 1b.—Same case after pneumolysis. Complete collapse of the lung.
- Fig. 2a.—Hanging cavity.
- Fig. 2b.—After pneumolysis.
- Fig. 3.—Cautery seen placed over an adhesion.
- Fig. 4.—Multiple adhesions.

### GAS REPLACEMENT IN PLEURAL EFFUSIONS

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ASPIRATION of pleural effusions under certain conditions has been a long-recognized procedure in treatment, but it was left to Holmgreen to recommend simultaneous substitution of air with aspiration of effusions, particularly in tuberculous pleurisy.

### INDICATIONS

(1) *Tuberculous pleurisy*.—The connection between the morbid conditions of the lung and pleura is so close that the interests of both are intimately connected. Collapse therapy has revolutionized our knowledge concerning diseases of the pleura and their treatment. The chief result of this new knowledge is the ability to make the effect of a pleurisy beneficial to the prognosis of the cases, by adopting a plan of treatment so as to support the healing factors connected with the pleurisy itself, and at the same time check the threatening factors involved in it.

Theoretically a primary idiopathic pleurisy is quite possible, but practically in all cases of pleurisy some signs of lung affection can be traced. Tuberculous pleurisy is in all probability due to a latent or unrecognized pulmonary lesion. Clinically it would be an extremely wise procedure from the patient's point of view to classify every pleurisy of doubtful ætiology as a case of pulmonary tuberculosis. The reason why this idea is not given wide credence by general practitioners may be that pleurisy from its very onset exerts a healing influence upon the original causal pulmonary lesion, bringing it to a temporary or permanent quiescence (Gravesen, 1925).

The pleural effusion keeps the lung in a state of collapse and hence has the beneficial effect of helping the lesion in the lung to heal. On the other hand, there are certain adverse effects due to effusion. The existence of pleurisy itself is an expression of allergy and activity of the disease. Moreover, the production of fluid may cause strain upon different organs, interfering with the metabolic and circulatory functions (Gravesen, *loc. cit.*). It might also cause respiratory and cardiac embarrassment. It is just to effect a *via media* so as to have the beneficial effects of collapse without the detrimental influences of effusion that gas replacement is advocated. This procedure has several advantages. Gas replacement enables all the fluid to be removed without any immediate change in size and position of the collapsed lung. Pleural effusion necessarily causes mediastinal displacement. In long-standing pleurisy, the body has become accustomed to a displaced mediastinum. Hence aspiration of fluid alone will naturally result in sudden expansion of the lung and replacement of the mediastinum back to its normal place



Fig. 1a.



Fig. 1b.



Fig. 2a.



Fig. 2b.

Photographs through  
the thoracoscope.



Fig. 3.

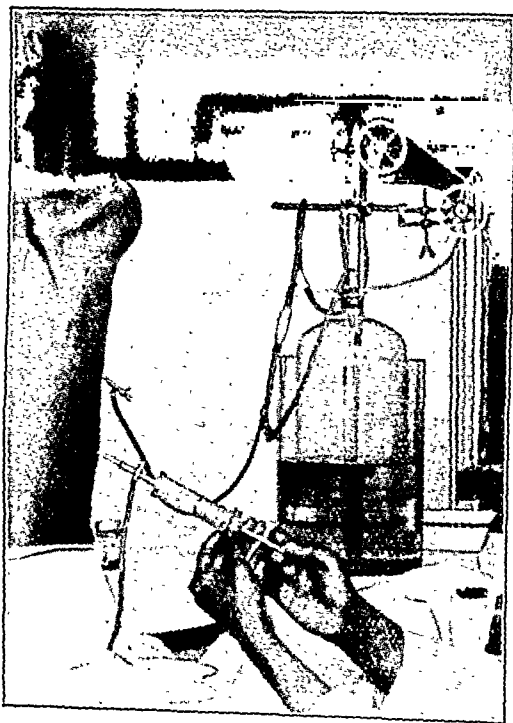


Fig. 4.



(which is for the moment abnormal under the altered circumstances). It may be accompanied by disastrous results. Gas replacement on the other hand is a much safer method and it can be done without any feeling of oppression on the part of the patient. Besides, as the lung remains collapsed there is no risk of its being injured by the needle while the effusion is being removed. Probably the greatest advantage of this method of aspiration is that it allows of examination of the underlying lung chiefly by radiography.

Gas replacement is the treatment of choice when pleural effusion occurs in the course of a manifest lung lesion, but is it indicated in serous pleurisy occurring as an initial manifestation of phthisis? Conservative treatment in such cases no doubt might bring about the desired result as a rule. Considering the practical impossibility of inducing pneumothorax at a



A new type of simple pneumothorax apparatus, with a bell jar suspended in water by counter-weights, allowing air to be sucked inside the pleural cavity while the fluid is being aspirated through one of the lower intercostal spaces.

later stage by necessity if the pleurisy is allowed to heal by conservative methods, I would suggest gas replacement in all cases of idiopathic pleural effusions suspected to be tuberculous. Moreover this is the only way by which one can make certain of the condition of the underlying lung. If the lung is found to be free from disease, it can be allowed to expand gradually. If on the other hand the lung is diseased, it can be kept collapsed by refills for the requisite period of time. Even in primary pleurisy no harm is done by replacing the effusion by air.

(Concluded at foot of next column)

## PNEUMO-PERITONEUM IN THE TREATMENT OF ADVANCED PULMONARY TUBERCULOSIS

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IN spite of many recent advances in the treatment of tuberculosis in the form of various surgical procedures advanced, bilateral pulmonary tuberculosis still remains a distressing therapeutic problem. Its treatment at present

(Continued from previous column)

(2) Even in pleurisy with effusion due to causes other than tuberculosis, gas replacement is to be done if aspiration is indicated, as this will enable removal of all the toxic material from the pleural cavity.

(3) Gas replacement can be done as a diagnostic measure in pleural effusion so as to enable thorascopic examination in cases of suspected tumours.

*Technique.*—Gas replacement is best undertaken by the use of two separate needles, one belonging to an aspirating set like the Potain's or Morton's aspirator and the other belonging to pneumothorax apparatus. They are introduced under local anaesthesia in different places in the chest-wall according to the circumstances of the case. I usually introduce the aspirating needle in one of the lower intercostal spaces in the posterior axillary line and the pneumothorax needle in the middle axillary line in one of the upper intercostal spaces above the upper level of the effusion. While the fluid is withdrawn a similar amount of air is simultaneously admitted. When the fluid has run down to the level of the cannula air will appear in the aspirating tube. At this stage the patient is tilted to the operated side and the cannula is so inclined that the remaining fluid can be aspirated from the lowest part of the pleural cavity. The cannula is then removed and the perforation sealed. The pneumothorax needle is removed after introducing sufficient air to produce the optimum intrapleural pressure.

I have used in some cases the same needle and cannula for alternate aspiration and gas insufflation.

Gas replacement has been done in 33 cases of pleural effusion in the tuberculosis department of the King George's Hospital, Vizagapatam. Six were primary tuberculous pleurisy, 14 were pleurisy with manifest lung lesions, nine in effusions developed during the course of artificial pneumothorax therapy, and four for diagnostic purposes.

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is only conservative with generally disappointing results. The brilliant achievements of collapse therapy in a few suitable cases naturally makes one feel that if the procedure could be extended with any benefit to these far-advanced cases, perhaps the prognosis might improve.

It is well known that many tuberculous women during the latter period of pregnancy show marked clinical improvement; sometimes the disease appears almost quiescent, only to flare up after delivery. The hormonal changes during pregnancy may be partly responsible for this, but the mechanical effect of the rise of the diaphragm due to the enlargement of the uterus during pregnancy, resulting in the relaxation and partial rest of both the lungs, is now recognized as an equally, if not a more, important factor in bringing about this clinical improvement. Similarly, during recent years, while treating intestinal tuberculosis with pneumo-peritoneum, simultaneous improvement in the co-existing pulmonary lesions was often noticed, and this is also equally explained as mainly due to the same mechanical effect, although the improvement in nutrition and general health brought about by pneumo-peritoneum in these cases is not a negligible contributory factor.

Until lately no advantage was taken of these observations. The idea of using pneumo-peritoneum in the treatment of pulmonary tuberculosis first occurred to Banyai (1934) who employed the procedure in a few cases and reported favourable results. Since then other workers have also corroborated his observations.

The treatment has a scientific basis. Pneumo-peritoneum by raising the diaphragm diminishes the apico-basal diameter of the lung and thus reduces its volume, except in a few cases where extensive costo-phrenic adhesions prevent the rise of the diaphragm. This effect compares very favourably with that obtained after a successful phrenic nerve paralysis. In some of our cases under pneumo-peritoneum the diaphragm was seen to rise as high as the third rib anteriorly. Secondly, it has also been shown that a sustained rise of the diaphragm limits the amplitude of its respiratory excursions, and the higher it rises the lesser are its movements. We have been able to corroborate the observation that at times in quiet breathing the diaphragm is seen to be almost stationary. The raised position of the diaphragm in comparative immobility obviously diminishes and at times almost abolishes the vertical movements of the lungs and thus gives them partial rest. The two main objects of collapse therapy—diminution in volume and limitation of movements—are thus met with by pneumo-peritoneum, and this mechanical effect secondarily results in passive hyperæmia and lymph stasis which are considered important contributory factors in the healing of tuberculous lesions.

During the past 2 years we have employed this method of treatment in 49 cases of pul-

monary tuberculosis. Only those were selected in whom, for some reason or the other, collapse therapy was either not feasible or was ineffective, and who were considered unlikely to improve on conservative treatment alone. Thus our indications for the treatment were: (1) bilateral extensive pulmonary tuberculosis unsuitable for collapse therapy; (2) bilateral pulmonary tuberculosis cases in which the patients were too ill for any form of collapse measure; (3) pulmonary tuberculosis with marked intestinal disturbance where collapse therapy was considered inadvisable, for the time being; (4) pulmonary hæmorrhage which could not be controlled with artificial pneumothorax; and (5) insufficient result of collapse therapy.

Of the 49 cases given this treatment, eleven received it for a too brief period (less than one month) to derive any appreciable benefit from it. From the clinical study of the remaining 38 cases we have gathered an impression that pneumo-peritoneum is a valuable method of treatment in certain types of pulmonary tuberculosis. It brings about marked clinical improvement in a few cases while giving symptomatic relief to many. Its first and early beneficial effect is the relief from troublesome cough and expectoration, and this was experienced by many of our patients under this treatment. During the earlier phases of the treatment the sputum is increased, as one would expect, but the patient is able to raise it easily, and this is a great relief to him. This facilitates effective drainage of pulmonary cavities and bronchial tubes, and as a necessary consequence of this the period during which cough and expectoration manifest themselves becomes short, allowing longer intervals of freedom from this troublesome symptom and consequently giving more rest to the lungs. In course of time, the amount of sputum is gradually diminished and so is the cough. The effect on temperature, however, is not so immediate. Although we were gratified to see early abatement of fever in a few cases, almost simultaneously with the decrease of cough and expectoration, it generally took some weeks before the fever showed any tendency to subside.

Digestive disturbances, particularly abdominal pain, are relieved by pneumo-peritoneum, resulting in better assimilation of food with improvement in nutrition and general health. In two of our cases only one refill completely removed the abdominal pain. In two others improvement in appetite and digestion with steady gain in weight occurred only after pneumo-peritoneum was induced. This obviously has a beneficial influence on pulmonary lesions as well.

In two cases hæmoptysis was controlled with pneumo-peritoneum. In one, artificial pneumothorax could not be induced on account of extensive adhesions, and as the patient continued to bleed profusely pneumo-peritoneum was given on two consecutive days with the arrest of

bleeding. After a week, a phrenic crush was performed and pneumo-peritoneum is being continued. In another case artificial pneumothorax was unsuccessful in controlling the bleeding because of inadequate collapse due to multiple adhesions, and although the hæmoptysis did not stop completely it was brought fairly under control after artificial pneumothorax was supplemented with pneumo-peritoneum. There was no profuse hæmoptysis after that, although clots and tinged sputum continued for a week or ten days. We fully realize that pulmonary hæmorrhage is a queer phenomenon. Frequently it stops automatically without anything being done for it, and often it persists no matter what we do to stop it, short of complete collapse with artificial pneumothorax. However, we have reason to suppose that in these two cases pneumo-peritoneum was directly responsible for the control of hæmoptysis which, we think, would have otherwise continued.

In addition to this symptomatic relief we found improvement in some cases radiologically as well: general clearing of the pathological shadows, diminution in the size of cavities, in some cases, and in a few their complete obliteration. We have seen that exudative lesions are benefited earlier than those with established fibrosis. The allergic manifestations in the lung clear up earlier under pneumo-peritoneum than they do under bed-rest regimen alone. In bilateral cases with gross extensive anatomical changes in one lung requiring early induction of artificial pneumothorax, which, however, is contra-indicated on account of contra-lateral disease, we found that in some cases the latter cleared up under pneumo-peritoneum within a period of 3 to 6 months, depending upon the extent of the disease, thus permitting the application of appropriate collapse measures on the more diseased side. We found this in 5 cases.

Theoretically, many indications suggest themselves for pneumo-peritoneum, but we have had no occasion to try it in any of them. So far we have used this procedure only in advanced bilateral cases either too ill or too extensive for any collapse measure. However, in addition to the case mentioned above in whom artificial pneumothorax was combined with pneumo-peritoneum to control the hæmoptysis, we have used this procedure in another case in combination with phrenic nerve paralysis to enhance the mechanical effect with satisfactory result. In another two cases a similar procedure is under contemplation. There are cases in which the rise of the diaphragm is insufficient after phrenic nerve interruption, and we have particularly noticed this after a temporary paralysis. The diaphragm can be raised higher by the addition of subphrenic pressure with pneumo-peritoneum. It is claimed that the amount of elevation of the diaphragm obtained by the combined effect of pneumo-peritoneum and phrenic paralysis is almost double that obtained by phrenic paralysis alone (Trimble and Wardrip, 1937).

The test of the efficacy of any method of treatment in pulmonary tuberculosis is said to be, and rightly so, its ability to change a positive sputum into a negative one. When judged from this standard our results are not encouraging, because so far only 3 cases out of 38 lost bacilli in their sputum, 2 in the sanatorium and the third was reported negative soon after his discharge. But in view of the far-advanced cases that were given this treatment, many of whom were too far gone for any line of action, this failure is not surprising. Moreover, important though this test is in judging the ultimate value of any method of treatment, it would be wrong to evaluate every method by this standard alone. A treatment which gives symptomatic relief to many, improves the general condition of the patient, and although it may not finally arrest the disease, it at least prepares the patient for a more effective line of attack, which was not feasible before, is not a mean factor in the therapeutics, even if it fails to satisfy the acid test. Pneumo-peritoneum has been seen to meet these requirements in a certain proportion of cases and, therefore, we feel that it has a therapeutic value in the treatment of some cases of pulmonary tuberculosis.

The technique of pneumo-peritoneum is similar to that of artificial pneumothorax. The site of puncture is about 2 inches below and lateral to the umbilicus on either side or an inch below the costal arch near the lateral border of the rectus muscle, preferably on the right side. For the initial induction and a few subsequent refills, the head-end of the bed is slightly raised. This helps the air to collect under the diaphragm and be recognized by the obliteration of liver dullness, which is an important indication of a successful pneumo-peritoneum.

After the preliminary anaesthesia the artificial pneumothorax needle, connected with the apparatus, is inserted, and while it is still in the abdominal wall the pressure bottle is raised and by momentarily connecting the air chamber with the manometer a positive pressure of about 20 mm. is registered on it. The intra-abdominal pressure in the lower abdomen is either neutral or slightly positive and, therefore, as soon as the needle enters the peritoneal cavity there is a sudden fall in pressure, as shown by the manometer, either to zero or to about *plus* 2 to *plus* 4 or slightly higher, depending upon the intra-abdominal condition. This is an important indication of the needle entering the peritoneal cavity (Dr. F. S. Master) and must always be looked for to avoid the complication of extensive surgical emphysema. It is important to remember that the fall must be rapid. Sometimes it is gradual which indicates that either the connections are not airtight or the needle is blocked and requires stiletting.

The initial 'fill' should not be more than 200 c.cm. which we consider the safe limit.

Some of our patients had most distressing pain over the shoulders and round the lower part of the chest even with 200 c.cm. at induction. This amount is gradually worked up by giving refills twice a week in the beginning and then weekly refills of 600 to 800 c.cm. depending upon the individual case. The *sine qua non* of successful pneumo-peritoneum treatment is to raise the diaphragm to its optimum level with the minimum respiratory movements, and then to maintain it at that throughout the course of the treatment by properly regulating the refills. This is a point the importance of which cannot be over-stressed. The amount of refill and the interval which will attain this object vary in individual cases, as these depend upon factors such as laxity of the abdominal wall, size of the abdominal cavity, presence or absence of costo-phrenic adhesions, sensitiveness of the patient, etc. It must, therefore, be determined by frequent fluoroscopic examinations. As a general rule an interval of more than a week is not advisable.

Beyond indicating the presence of the needle in the peritoneal cavity the manometer is not a helpful guide in this treatment. Frequent fluoroscopic checks, clinical observation, and the patient's sensations are more reliable indications than the manometer readings. When, however, the manometer shows a rise in pressure as the air enters, it is advisable not to exceed it beyond *plus 12* or *plus 15*, preferably stopping at *plus 10*, as higher pressures are not well tolerated by many; they lose appetite and the digestion is impaired. A few cases show these symptoms of intolerance when the refill is larger than a certain amount even if the pressures are not increased.

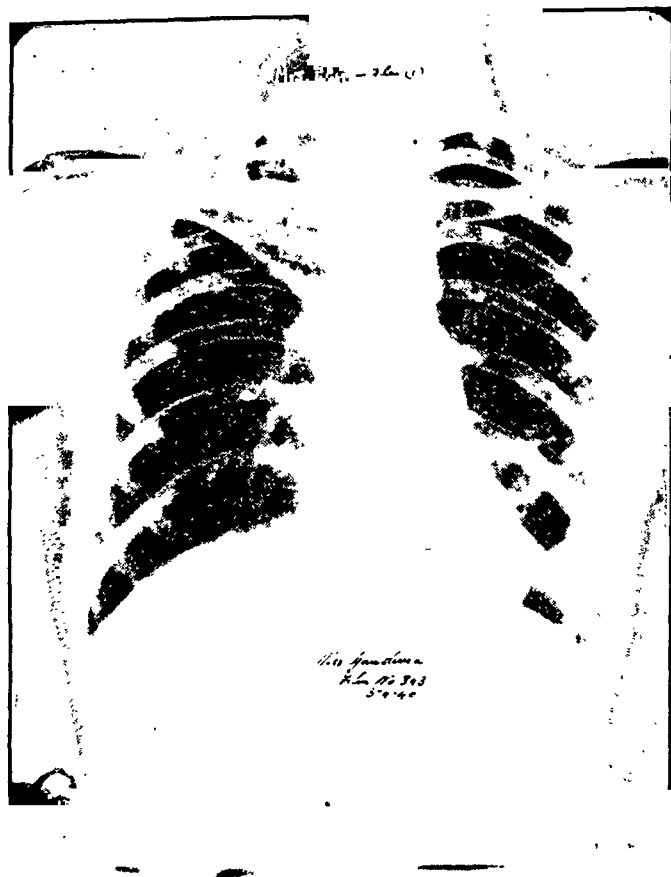
The action of pneumo-peritoneum is primarily mechanical and depends upon the rise of the diaphragm; the higher the rise the greater is the effect. In cases with costo-phrenic adhesions the respiratory excursions of the diaphragm are restricted, and consequently its rise after pneumo-peritoneum is also less with a proportionately limited therapeutic effect. With strong and extensive adhesions, the diaphragm is almost stationary and there is no rise. In such cases pneumo-peritoneum is not likely to be of any benefit. A preliminary fluoroscopic examination is, therefore, very necessary to determine previously the range of movements of the diaphragm and the suitability or otherwise of the case for pneumo-peritoneum. Moreover, the rise of the diaphragm must be even to have the full mechanical effect. In not a few cases we have seen that the anterior part of the dome rises fairly high while the posterior portion is almost fixed below. This is evidenced by the fact that the lung markings are clearly seen in the air space created by pneumo-peritoneum below the diaphragm. This uneven rise of the diaphragm can also be visualized by lateral screening. In such cases the rise is only partial and consequently the pulmonary relaxation is

not uniform. The therapeutic effect, therefore, is also proportionately less. Those of our patients who had a high rise of the diaphragm with the clear air space below it benefited the most, both clinically and radiologically. Others derived benefit proportionately less, while those in whom there was no rise of the diaphragm did not have any benefit at all.

Here it must be emphasized that a mere pad of air below the diaphragm does not always mean that it has risen. In cases with a rigid diaphragm the air space is created entirely by the downward displacement of the liver and the stomach. Similarly, in cases with movable diaphragm, the distance to which it has risen is not given by the height of the air space below it, because here too the space is partly made up by simultaneous downward displacement of the subjacent viscera. The rise of the diaphragm is measured either by its relation to the ribs before and after the refill or by the difference between the perpendicular distances measured from the clavicle to the highest point on the curvature of the diaphragm before and after the treatment.

In the treatment of pulmonary tuberculosis with pneumo-peritoneum, refills have to be large in amount and more frequent to ensure a sustained rise of the diaphragm at its optimum level. As a consequence of this there is sometimes a marked displacement of intra-abdominal organs and the digestive functions are interfered with. In such cases the feeds should be smaller and more frequent to ensure proper assimilation and nutrition.

Pneumo-peritoneum is said to be a safe procedure, and we also found it so. However, we met with three cases of what we consider to be peritoneal shock. In two it was of a milder type and occurred at a refill, while in one it was of a more serious nature. There was no trouble during the preliminary anaesthesia, even when the needle pierced the peritoneum, but, in two cases, when the other needle was inserted and hardly 50 c.cm. of air had flowed in, the patient suddenly fainted with perspiration on the forehead, hands and feet and some gurgling in the abdomen, while the third patient suddenly became unconscious and pale, eye-balls rolled, the breathing slowed down and so also the pulse rate. The needle was at once removed, injection of strychnine and digitalin was given and the patients came round in a couple of minutes. Perforation of the gut is the most dreaded accident with pneumo-peritoneum, but this is considered unlikely. 'If the needle is slowly forced inwards (slightly oblique), the omentum and the intestines being soft, pliable, and movable, are pushed in front of the needle but are not punctured' (Banyai, 1937), unless a portion of the gut is adherent to the abdominal wall at the site of puncture. Still markedly tympanitic areas should be avoided. Except subcutaneous emphysema in a few cases—in one case from



Mrs. P. P. G. Fig. 1.—Bilateral disease with a cavity at the right apex and active infiltration at the left base. Sputum over two ounces in 24 hours, positive to tubercle bacilli.

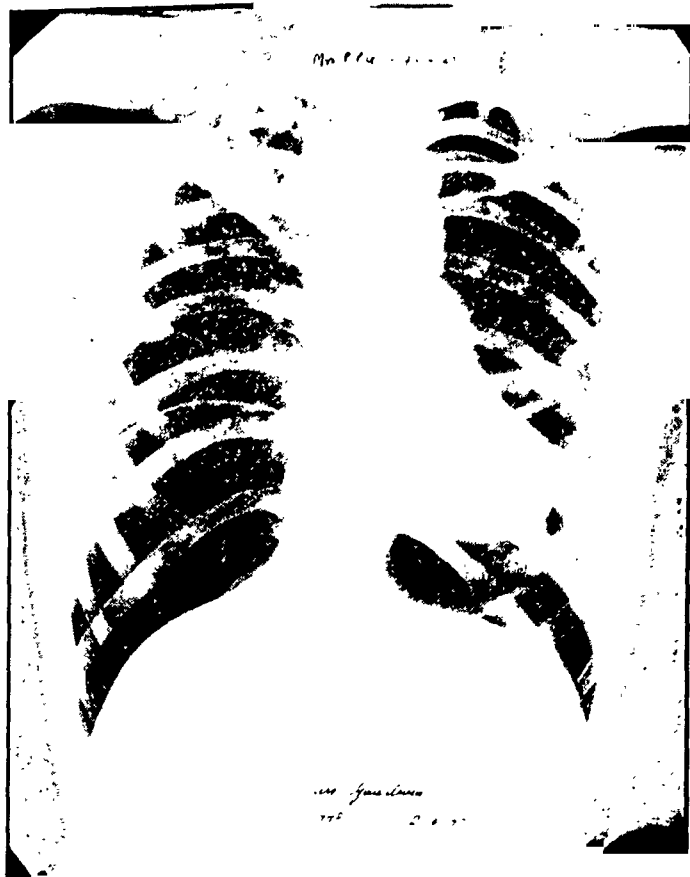
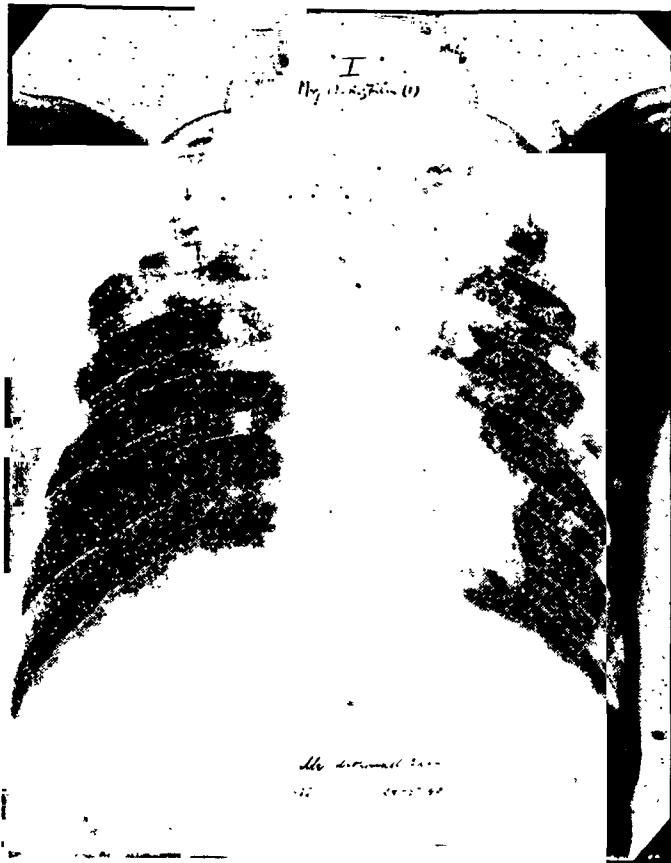


Fig. 1a.—After one month's treatment with pneumo-peritoneum diaphragm raised to the 3rd interspace on the right side and 4th interspace on the left. The right interlobar septum is proportionately pushed up and the size of the cavity diminished.



Fig. 1b.—Taken two months later. The right dome is raised to the level of the 3rd rib and the left to the 4th rib anteriorly. The right interlobar septum is further pushed up above the clavicle and the cavity practically closed up; proportionate improvement on the left side. Sputum less than a drachm in 24 hours, only occasionally positive to tubercle bacilli, very few bacilli being detected.



Mr. M. K. Fig. 2.—Extensive bilateral disease with multiple cavitations. Sputum over two ounces in 24 hours, strongly positive to tubercle bacilli. Marked intestinal disturbances.

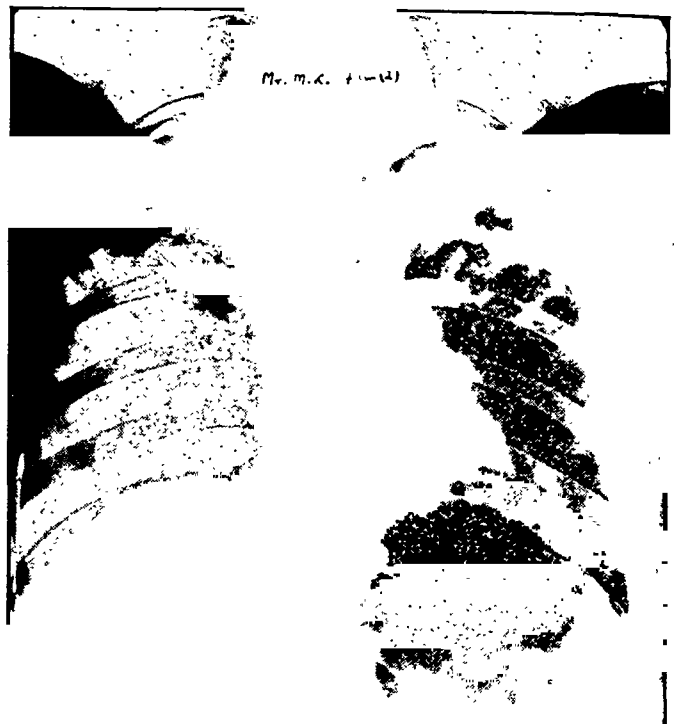
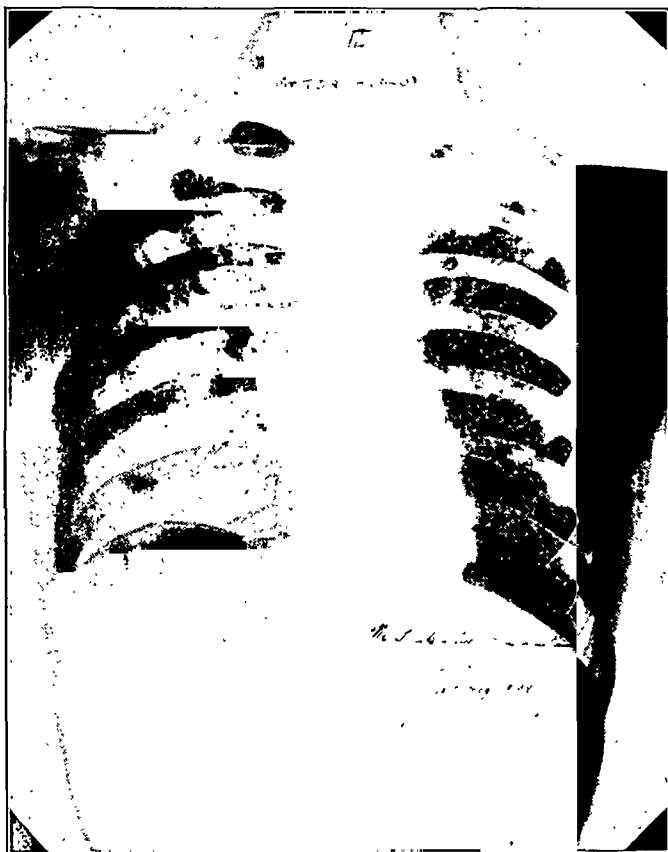


Fig. 2a.—After 12 months' treatment with pneumo-peritoneum diaphragm pushed up along with the liver by a little less than one interspace; considerable clearing of diseased areas on both sides with diminution in size and number of cavities; very little sputum, positive to tubercle bacilli. Marked improvement in intestinal condition.



Mr. T. D. R. Fig. 3.—Bilateral disease with cavitation persisting after 17 months of conservative treatment. Sputum over two ounces in 24 hours, strongly positive to tubercle bacilli. Marked intestinal trouble with no tendency to increase in weight.



Fig. 3a.—After 20 months' treatment with pneumo-peritoneum, marked clearing on both sides with closure of cavities; both the domes of the diaphragm raised by one interspace; sputum about one drachm in 24 hours, positive to tubercle bacilli. Marked amelioration in intestinal condition with steady increase in weight.

the neck to the scrotum—and a large hæmatoma in three cases we met with no serious complication.

**Criticism.**—The action of pneumo-peritoneum being similar to that of phrenic nerve paralysis, it may be argued that the procedure is useful only in middle or lower lobe affections and that it has no effect on the upper lobe lesions; and as pulmonary tuberculosis is generally a disease of the upper lobe, it is of no value in a large majority of cases. But this argument is not sound. Generalizations are never good in tuberculosis. Although, other things being equal, middle and lower lobe affections are more benefited by pneumo-peritoneum, as well as by phrenic interruption, than the upper lobe lesions, the location of the disease is not the only determining factor. The character of the lesion is an equally, if not more, important consideration than merely its situation in the lung field. Dense fibrotic areas, thick-walled cavities, also adherent cavities are not influenced by pneumo-peritoneum, or by phrenic interruption—as a matter of fact such lesions are definitely unsuitable for these measures—even when situated in the lower lobe and a satisfactory rise of the diaphragm has been obtained. On the other hand, early and thin-walled cavities surrounded by healthy tissue and cavities surrounded by an exudative area (not fibrotic) are materially benefited by these procedures, even if situated high up in the upper lobe. Davies (1933) has clearly observed while discussing the value of phrenic paralysis that unless the adhesions prevent it, the mechanical effect of the rise of the diaphragm is evenly distributed throughout the whole lung and the pulmonary relaxation is most marked where the diseased area is already showing strong tendencies to contract, thus giving selective relaxation with selective therapeutic effect. These observations are amply supported by the obliterations of apical cavities in suitable cases by phrenicectomy. In two cases of the present series apical cavities closed under pneumo-peritoneum. In one of them there were bilateral apical cavities which resisted conservative treatment for over one and a half years.

The argument that pneumo-peritoneum does not give complete rest to the lungs does not lessen its value when we remember that in a low-tension artificial pneumothorax, which is much in favour to-day, the movements of the lungs are not completely abolished, neither in many cases of bilateral pneumothorax where of necessity the collapse has to be of low tension.

It might be argued that the results of pneumo-peritoneum, at least what we got in our present series, might have as well been obtained only on bed-rest regimen. Possibly so, but looking to the clinical condition of many of our cases in this series our impression is that this was unlikely. Moreover, many of our cases were given a reasonable trial on bed rest before putting them under pneumo-peritoneum. One case of bilateral apical cavities resisting conservative

treatment for 18 months, but closing under pneumo-peritoneum, has already been mentioned above, and a few other cases can also be cited whose improvement can be definitely attributed to pneumo-peritoneum. Besides this it cannot be gainsaid that pneumo-peritoneum gives additional rest to the lungs and thus enhances the effectiveness of conservative treatment, and is therefore bound to be of some help. It may materially shorten the period of bed-rest regimen, besides making it comfortable owing to symptomatic relief. Above all, the procedure has a beneficial psychological effect in that the patient who is too far gone for any treatment beyond bed rest feels that he is being actively treated, his troublesome symptoms are ameliorated, his nutrition and general health improved, and thus he is brought back from a state of despondency and despair into a more hopeful mental attitude which is a great asset in the recovery from tuberculosis. The treatment, therefore, has a great palliative and curative value.

Plates XXXV and XXXVI illustrate the progress in three cases.

#### Conclusions

(1) Pneumo-peritoneum is a valuable measure of treatment in some cases of advanced bilateral pulmonary tuberculosis either too ill or too extensive for any measure of collapse therapy.

(2) It is also useful as a temporary measure to prepare the patient for a more effective line of treatment as much as artificial pneumothorax is sometimes used to improve the contra-lateral disease with a view to doing thoracoplasty subsequently on the more diseased side.

(3) It is a valuable adjunct to phrenic nerve interruption where the rise of the diaphragm is insufficient, also in certain cases of artificial pneumothorax.

(4) Its early beneficial effect is to give relief to the troublesome cough and make expectoration almost effortless, thus establishing an effective drainage of pulmonary cavities and bronchial tubes.

(5) By giving rest to the lungs it reduces toxæmia.

(6) In two cases it was able to control hæmoptysis.

(7) Exudate lesions are benefited earlier and better than those with established fibrosis.

(8) Fibrotic lesions, thick-walled cavities, and adherent cavities are not influenced by pneumo-peritoneum and such cases are unsuitable for this treatment.

(9) The *sine qua non* of successful pneumo-peritoneum treatment is to raise the diaphragm to its optimum level and to maintain it at that throughout the treatment.

(10) The improvement is proportional to the rise of the diaphragm. Hence cases with strong costo-phrenic adhesions rendering the diaphragm rigid and fixed are not suitable for this treatment.

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## THE FORMATION, EVOLUTION, AND HEALING OF TUBERCULOUS CAVITIES IN THE LUNGS

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CAVITIES in the lungs were known to the Hippocratic school of medicine. However it was not until the 17th and 18th centuries that these cavities became associated with tuberculosis. It has been possible to detect large-sized cavities in the lungs by means of physical examination for a long time, but it was not until after the advent of x-rays that the nature of pulmonary cavities was studied at first hand. It is radiology coupled with systematic post-mortem examinations, and lately cavernoscopy that revealed the mode and site of formation, evolution, behaviour and mode of healing of cavities.

In this article an attempt is made to review present-day knowledge regarding pulmonary cavities.

### I. Formation

When tubercle bacilli enter into a suitable host, they produce exudative and proliferative changes, the extent and intensity of which depend upon the resistance of the host and the structure of the tissues, and upon the number and virulence of the bacilli. These changes culminate in the absorption of the products of exudation and proliferation or in their necrosis and caseation.

When the resistance against infection is high, the caseated tissue may become inspissated, encapsuled, fibrosed, calcified and ossified, in that order. But where the resistance is low, softening and liquefaction of the cheesy material takes place. The softening is due to an absorption of water causing a swelling of the necrotic cellular debris (Goldberg, 1941). Liquefaction is the result of an immigration of polymorphonuclear leucocytes. These leucocytes break down and liberate proteolytic enzymes which digest the caseous material. Early suppurative liquefaction stops at the border of the caseation, and a wall of non-specific granulation tissue is built around before the liquefaction reaches the border.

### Walls of cavities

The walls of the cavities are formed in layers often visible to the naked eye. The inner lining usually consists of necrotic tissue, degenerating leucocytes and fibrin. In this layer, tubercle

bacilli proliferate luxuriously and often form dense clumps. The lentil-shaped bodies in the sputum of patients with cavities, which are eagerly sought for by pathologists, because they are so rich in bacilli, are pieces of this necrotic membrane. The inner lining rests on a deeper layer usually consisting of a firmer purple-grey tissue which in turn rests on the outer coat of granulation tissue with numerous small round cells. Where the cavity-wall merges with surrounding lung tissue discrete tubercles containing giant cells are found.

The walls of newly-formed cavities are irregular and jagged, and appear to vary in their thickness when seen in serial x-ray examination, within short periods of time. The walls of old-standing cavities are firmer and more uniform and do not vary so frequently. It is a common observation under the x-rays that a jagged, irregular, and indistinct wall of a cavity, when partially collapsed by pneumothorax appear thicker, smoother, and more regular.

A characteristic of older tuberculous cavities seen on the post-mortem table is the presence of ridges protruding from the inside of the walls and trabeculae crossing the lumen of the cavities and fusing with the opposite walls. These ridges and bridges consist of firm fleshy tissue and are derived from the larger blood vessels which resist liquefaction. While the veins are occluded by thrombi, the arteries are obliterated by proliferative endarteritis. In spite of this productive obliterating process, sometimes an aneurism develops from an artery in a tuberculous cavity, which may rupture and cause a severe hæmoptysis.

### The content of cavities

The content of cavities is pus formed as a result of the liquefaction of caseous material. Pieces of caseous material may be found floating in the pus. It is this pus which when spat into water floats and takes a circular shape and is described as 'nummular sputum'. The pus may be thick and creamy, or thin and watery. It may be yellow, greenish or blood-tinted owing to small hæmorrhages from the limiting membranes. Erosion of an artery or small aneurism causes the cavity to become filled with blood clots which may arrange themselves in concentric layers.

Much controversy has raged with regard to the frequency of mixed infections in tuberculous cavities. Pus taken from tuberculous cavities usually contains no organisms but tubercle bacilli. Even the ordinary pus-forming organisms are not as frequently found as might be expected. Anaerobes are found in only about 12 per cent of large cavities in the living. However, it is a remarkable fact that anaerobes such as the bacillus of Welch are said to be found in almost 100 per cent of giant cavities in the cadaver.

When most of the liquid content of a cavity has been coughed out, the cavity appears as a

(Continued from previous page)

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hole in the lung filled with air. Under the  $x$ -ray screen a small quantity of residual pus is often seen shaking at the bottom of cavities and is of diagnostic value.

The air in the cavity is ordinarily at atmospheric pressure. Sometimes it may show higher pressure and sometimes lower. Pressures as low as  $-56$  mm. of mercury are reported to have been found in large cavities.

Ordinarily the composition of the air in cavities is practically the same as that of outside air, but sometimes it is found richer in  $\text{CO}_2$  and poorer in  $\text{O}_2$  than outside air.

#### *The draining bronchi*

In the process of caseation and liquefaction the very small bronchi are destroyed while the larger ones become the outlet for accumulating pus.

Draining bronchi may be single or multiple, large or small. It has been found that 98 per cent of large cavities have only one bronchus that functions effectively as drainage.

When the draining bronchus is single and large enough to be seen in the  $x$ -rays and the attachment is straight the cavity has been described as a tennis-racket-cavity or a stem-cavity. When the attachment is at a tangent, the opening tends to be valvular and has been called saxophone opening. During inspiration air enters freely through such openings into the cavities, but during expiration or coughing pus and air do not escape freely.

Post-mortem examinations and cavernoscopy have shown that the opening of a cavity may be situated at the top or bottom or side of a cavity and that it may be placed at the bottom of a funnel soaked in pus or at the apex of a fleshy cone which projects into the cavity.

The bronchial opening may be widely open or small and narrow. It may be temporarily or permanently blocked. It may be intermittent, i.e., opening and closing at intervals, or it may be valvular, i.e., admitting passage in one direction only. Ninety per cent of cavities have however open drainage. It is estimated that 73 per cent of temporary blocks are due to mucus plugs (Coryllos and Ornstein, 1938), the remaining being due to congestion and cedema of the bronchial lining wall. Permanent blocks are usually due to fibrosis or kinking of the bronchi.

#### *II. Evolution and behaviour*

Formerly it was thought that phthisis was essentially a chronic disease requiring long periods of time to develop. The fact that cavities can form in the lungs in periods as short as one or two weeks (Zorini, 1934) was practically unknown in the pre- $x$ -ray days.

Productive as well as exudative lesions in the lungs may lead to cavity formation. However, the exudative lesions are of greater significance and most of the larger and more rapidly-forming cavities can be traced to them.

As a rule cavities grow in a caudal direction, probably because in the erect position the pus

is in contact with the bottom of the cavity. Extension of a cavity from one lobe into an adjacent one is rare, and takes place only at a late stage of the disease when the originally-affected lobe is almost completely involved.

The shape and size of the cavities vary very much depending on the mode of formation and the subsequent changes in the surrounding tissues. Cavities may be only just large enough to be visible in the  $x$ -rays or they may involve one whole lobe or even more. The shape may be spherical, ovoid, lobulated or very irregular with pouches and fistulous tracts running in different directions.

For some reason or another the most favoured sites for the formation of cavities are the peripheral, lateral and dorsal regions of the lungs. The apex of the lower lobe is more prone to be affected than the base of the upper lobe.

Modern observations with the help of physical examinations, fluoroscopy, serial radiography, tomography, thoracoscopy, cavernoscopy, pressure recording manometers and post-mortem examinations, show that pulmonary cavities behave in a manner which is difficult to explain. For example the following phenomena may be mentioned:—

*Silent cavities.*—A lung over which hardly any of the classical physical signs of excavation, such as râles, cavernous or amphoric breathing, etc., are present may reveal a large cavity when radiographed. All the signs of cavity may be evident over the same lung at another time.

*Vanishing cavities.*—A cavity which is clearly revealed in the  $x$ -rays may have vanished without leaving almost any trace two weeks later. This may happen to cavities larger than the size of a rupee and with a level of sputum standing and shaking in them.

*Accordion cavities.*—This name is given (Coryllos, 1933) to cavities which under serial  $x$ -ray examinations appear to enlarge and contract periodically. Usually when the cavities appear large, they are empty, but their walls look thick; while in the contracting stage they may contain a layer of pus and their walls appear thinner.

*Balloon or tension cavities.*—Occasionally a cavity is found to enlarge rapidly without any radiographic signs suggesting extension of the lesions or sloughing of the lung parenchyma around. In such cases the manometer usually records an air pressure higher than atmospheric pressure in the cavity.

*Migrating cavities.*—Cavities situated in one particular interspace may be found to have become smaller and moved to a higher space after a phrenic interruption operation on that side. Also, a cavity which is situated in the outer half of a lung may sometimes be found to move behind the mediastinum without collapsing completely under artificial pneumothorax (A-P). Apart from these movements which are

easy to understand, there are cavities which appear to move without any evident reason. For example a cavity situated just below the clavicle in a radiogram may appear to have moved above the clavicle in a subsequent radiogram taken under the same conditions and technique as the first one.

*Hanging cavities.*—It is often observed in A-P cases that even when one whole side of a cavity is adherent to the chest wall the cavity gets collapsed and heals, and tubercle bacilli disappear from the sputum rapidly, whereas other cavities which are held up by only a thin string adhesion refuse to collapse or heal, although they may be surrounded by air under pressure. It is also observed by surgeons who do closed internal pneumolysis that the results of these operations with regard to cavity closure vary considerably according to the nature and site of the adhesions (see plate XXXVII, figures 3, 4 and 5). In some cases the cavities close easily after the severing of the adhesions, while in others they do not, even when all adhesions are cut.

Possible explanations of some of these phenomena will be mentioned in the discussion that follows.

#### *Healing of cavities*

Since the advent of collapse therapy, it is admitted on all hands that even large cavities can and do heal provided that a complete collapse is obtained and maintained for a sufficiently long time. It is also generally admitted that cavities of 2 to 3 cubic centimetres or less may heal spontaneously and leave hardly any trace. However, there has been much controversy between clinicians and morbid anatomists as to whether cavities of larger diameters fill up or get obliterated and heal (de Marchi, 1938). Clinicians claim (see figures 1 and 2) that in the large number of instances where cavities heal, the morbid anatomists do not get a chance to look at the lungs on the post-mortem table; while the morbid anatomists claim that in the so-called healed cases, residual cavities remain but are not detected by physical examination or radiology, and that these cavities tend to enlarge again after the period of treatment by bed rest, etc.

In 1928 the fate of 1,454 patients in whom tuberculous cavities had been diagnosed were followed (Barnes and Barnes, 1928). Eighty per cent of these patients died within one year and 95 per cent within 15 years. The great progress in roentgenological diagnosis of incipient cavities and in the surgical treatment of pulmonary cavities will however make the future statistics much more favourable.

Textbooks describe a condition called 'open healing'. It is said that the cavity heals in spite of its remaining open. 'The pyogenic membrane gradually disappears and the internal lining of the cavity becomes smooth and shiny. In places transitional or squamous epithelium derived from the bronchi may cover the free

surface. The sputum is free of tubercle bacilli and there is no immediate danger of progression or aspiration'. Now it is admitted that a patient can have an open cavity and yet be free from practically all symptoms of disease. The author of this article must, however, confess that during a decade of close and continuous study of tuberculous cases, he has not met with even one case which originally had tubercle bacilli in the sputum becoming bacillus-free for any length of time while the cavity remained open as seen in the x-rays.

#### *Discussion and Conclusion*

During recent times the study of the draining bronchi of cavities and their openings into cavities have assumed great importance. These studies have not only produced clues to the explanation of the behaviour of cavities but also placed the therapeutic value of bed rest and 'open air' in cavity cases on a more rational basis, and have shed fresh light on the mechanism of action of collapse therapy.

The production of cavernous breath sounds depends on the passage of air over the opening of the cavity. When it is remembered that a draining bronchus may be temporarily blocked by congestion or a mucus plug or advancing fibrosis, preventing air entry, the phenomenon of silent cavities is easily understood. When the bronchial opening of a cavity is blocked, there is accumulation of pus, while the air in the cavity gets absorbed, in the same way as air in a pneumothorax gets absorbed. The thinner the walls and healthier the surrounding tissues, the quicker the absorption. As the air gets absorbed the negative pressure produced draws the walls of the cavities in, causing the surrounding retracted lung tissues to re-expand and fill up the cavity space. This explains the phenomenon of vanishing cavities. If the space to be filled is small, the re-expansion of the surrounding retracted alveoli would be enough to fill the space, but when the cavity space is large, the negative pressure in the cavity may be so great as to produce emphysema in the surrounding tissues. If the cavity is very large and the surrounding tissues unhealthy, no amount of negative pressure would be adequate to fill up the cavity.

Intermittent opening and closing of a bronchial aperture would produce an expanding and contracting cavity. If the opening is valvular and air enters with deep inspiration, but does not escape on expiration or coughing, then a balloon cavity is produced.

If the bronchus of an area of lung adjacent to a cavity becomes involved in the disease and blocked, the atelectasis produced (Coryllos, 1933) draws the cavity towards the shrinking lung and a migrating cavity is produced.

If the collapse produced by artificial pneumothorax, intra-pleural pneumolysis, or thoracoplasty is such that it kinks or in other ways tends to close the bronchus of the cavity, then cavity-closure and sputum-conversion are



Fig. 1 (T. P., Hindu, male, age 25 years).—Shows two symmetrical cavities of more than a rupee size—one in each lung. Tubercle bacilli in sputum.

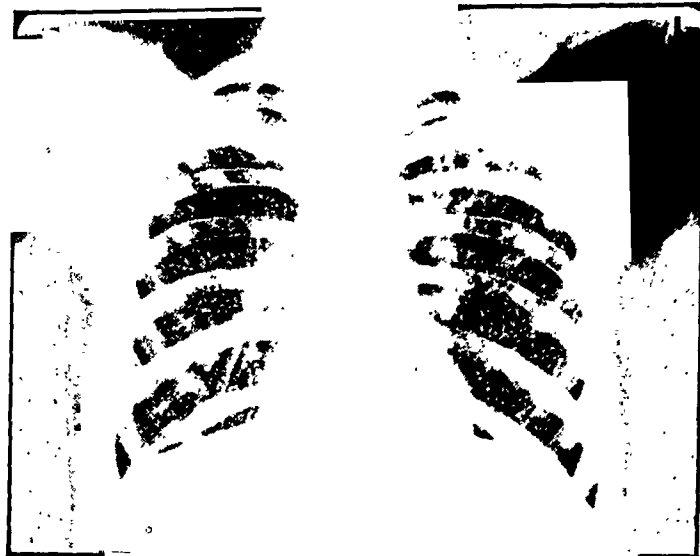


Fig. 2.—Same patient as figure 1—taken 5 months after the first picture. Both cavities disappeared. The patient had no treatment other than bed rest and sanatorium routine treatment. On discharge, the sputum was persistently negative to tubercle bacilli and the patient had gained 45 pounds in weight. Nine months after discharge, no cavities seen, patient keeping well, no tubercle bacilli in sputum.

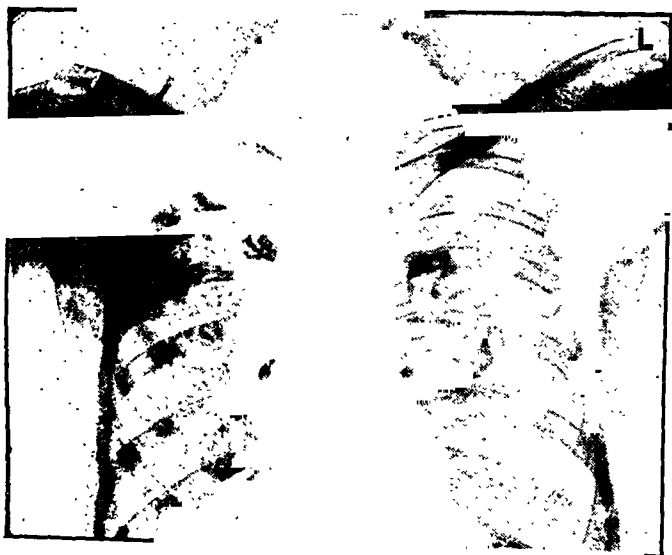


Fig. 3 (D. R., Hindu, male, age about 30 years).—Left lung under partial collapse. Several cavities held open by apical pleural adhesions. Right lung extensively diseased, but no definite outlines of cavities visible.

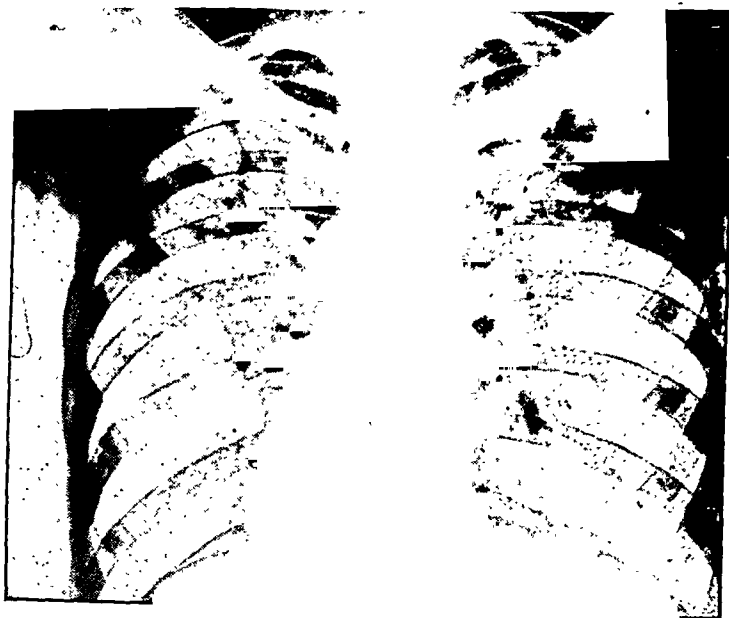


Fig. 4.—Same patient as figure 3. The adhesions on the left have been severed by internal pneumolysis. The apex dropped immediately and all cavities closed soon. Artificial pneumothorax on right side. Large cavity mid-zone held open by a thick adhesion directed towards the axilla.

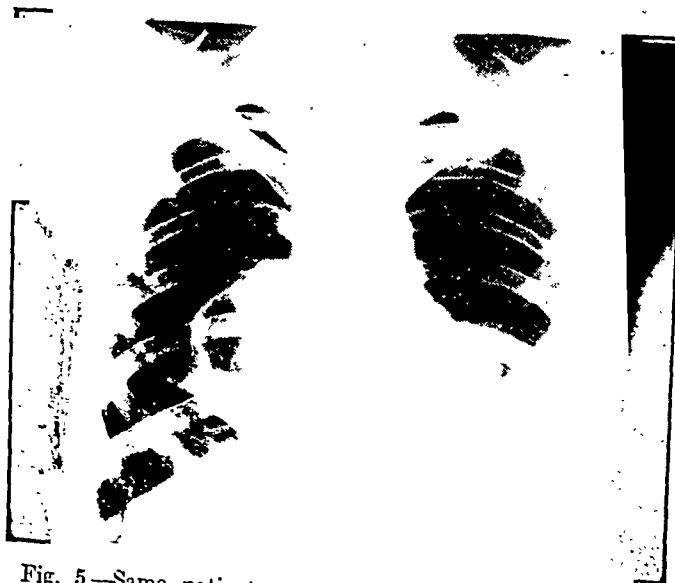


Fig. 5.—Same patient as figures 3 and 4. Adhesion on right side also severed (stump clearly seen). But the cavity had not closed when the patient left the author's observation.



effected much more quickly than otherwise. For example, a downward drop of the apex of a lung produced by artificial pneumothorax or by section of the first and second ribs, or by the severing of an apical pleural adhesion, tends to cause a kink in the upper bronchi, an apical cavity closes soon, and the sputum becomes free of tubercle bacilli rapidly; whereas a cavity near the hilus with a wide and short bronchial outlet may resist all forms of collapse therapy.

The tubercle bacillus is an aerobe. A pulmonary cavity filled with air is an ideal place for its growth. But when the bronchus is blocked and the air in the cavity is absorbed the condition in the cavity becomes less favourable for the multiplication of tubercle bacilli. If the cavity and the lung are collapsed together and the whole organ converted into an air-free mass, tubercle bacilli will find it still more difficult to grow in it.

Tubercle bacilli as well as the cells of the human body are aerobes, and fresh air benefits both. The problem is to give sufficient fresh air to the cells of the body while withholding it as far as possible from the tubercle bacilli.

Haldane (Goldberg, 1941) observed that in shallow breathing only about one-seventh of the air contents of the lungs are renewed and when the patient is at rest in bed the breathing is at its shallowest and the natural air entry into the lungs is at its minimum. Moreover, during rest, the diseased bronchi have a greater tendency to close up, whether it be due to plugs which remain undisturbed or due to healing by fibrosis and contraction. Thus, bed rest helps in achieving the result of withholding fresh air from the bacilli-containing cavities, thereby creating physical conditions resembling those in a closed cavity which tends to heal rapidly. Collapse therapy, however, achieves this result in a more specific manner.

It would be an exaggeration to claim that the benefit obtained by tuberculous cavity cases from general bed rest or from local rest as in collapse therapy is all due to the diminution of air supply to the cavities. It is nevertheless a possibility that the diminished air entry into cavities plays an important part in the mechanism of healing produced by rest in bed and collapse therapy.

#### Acknowledgment

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## BONE AND JOINT TUBERCULOSIS : A REVIEW OF 175 CASES

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TUBERCULOSIS of bone is a relatively common, disabling disease of childhood and young adult life which begins in cancellous bone. The joint or bone lesion is thought to be always secondary to pulmonary, gastro-intestinal, or glandular foci. The occurrence of a lesion in bone indicates that the resistance of the soft tissue is high (Christopher, 1939). The infecting organism may be human, bovine, or avian in type, but the marked reduction in bone tuberculosis in countries which have adopted pasteurization of milk on a wide scale and tuberculin testing of cattle leads one to believe that most commonly the organism is bovine in type and origin. Amberson takes exception to this and states that only 0.4 per cent of tuberculosis of the spine is from infected cattle (Gill, 1940).

#### Pathology

The route of infection is hæmatogenous; minute emboli of organisms lodge in the capillaries adjacent to the epiphyseal cartilage. The implantation of emboli is due to the peculiar anatomical loop arrangement of the smaller blood vessels prior to epiphyseal closure. Small infarcts are followed by typical tubercles which produce bony destruction without stimulating reparative reaction. Tuberculous processes are destructive and very little formative in contrast to pyogenic infections of bone which are at once destructive and formative, while syphilitic processes are almost always formative. Extension to the joint in tuberculosis results from destruction of the epiphysis and articular cartilage (Boyd, 1938).

#### Diagnosis

- (A) Primary focus (pulmonary, gastro-intestinal) or glands;
    1. Sputum—acid-fast staining and guinea-pig inoculation.
    2. X-ray of the chest.
    3. Excision of gland with histological study and guinea-pig inoculation.
    4. Stool examination.
  - (B) Secondary focus (local bone lesions).
    1. Tuberculin test.
    2. Aspiration of joint fluid and guinea-pig inoculation.
    3. Excision of gland draining involved joint with histological study and guinea-pig inoculation.
    4. Acid-fast staining of pus.
    5. X-ray of involved joint.
    6. Biopsy of involved joint.
- The diagnosis of tuberculosis of bone is not easy. In reviewing 175 cases it is apparent that the full value of various diagnostic procedures



is not widely appreciated. Early diagnosis as regards the final result may not be of great value if the patient is in the hands of an expert who does not use specific treatment until sure of a diagnosis, as the end-result of nearly all bone tuberculosis is ankylosis no matter how well the patient is treated; but in the hands of the innocent, the adoption of specific measures before specific aetiology has been decided may be very tragic. This is best illustrated by (a) needless amputation; (b) the incision and drainage of a tuberculous joint. This is tragedy to the patient as it usually condemns him to a life of draining sinuses due to secondary infection. Secondary infection invariably follows drainage of tuberculous joints and should never be practised. Aspiration of pus is the method of choice to remove any pus present. Joints already infected secondarily do not fall in this category. Chronic mono-articular arthritis in a child should always be regarded as tuberculous until proved otherwise. The same is true of a painful back in a child. Multiple articular processes, other than those in the wrist, hands, ankles, and feet diagnosed as tuberculous should be regarded with great scepticism.

The *tuberculin test* should always be done in a suspected case of bone tuberculosis. A negative test is strong evidence that the patient does not have tuberculosis but a positive test is only suggestive in that it shows the patient has, at some time, harboured the bacillus and become sensitive to it (Cecil, 1933). This test was performed in 24 of my cases.

*Aspiration of joint fluid and guinea-pig inoculation* is a positive test of great value. If the guinea-pig develops tuberculosis, the diagnosis is made; if it does not, the patient probably does not have tuberculosis. In this series this test was not used. Pickoff (1939) reports the diagnosis of tuberculosis in 10 to 12 days by taking one gramme of fine amorphous non-purified silica powder ( $\text{SiO}_2$ ), and placing it in a sterile flask with 20 c.cm. of boiling saline; it is shaken and allowed to cool, and 1 to 1.5 c.cm. is injected subcutaneously into the flank of a plucked guinea-pig. The suspected material is concentrated and injected through the same skin puncture to the same depth and in the same direction. The skin puncture is closed with collodion. The site is examined every few days and if by 10 to 12 days a firm induration develops some of the exudate is obtained by aspiration for examination on a slide. If negative, the process is repeated in 3 to 4 days. The animal is kept for 1 month as a check. It is thought that silica by enhancing the factor of tubercle strain virulence probably spares the bacilli much of the initial struggle against the guinea-pig defences, permitting them to proliferate earlier.

*Excision of a gland draining the joint with guinea-pig inoculation and histological study* has been found to yield positive results in about 80 per cent of cases of the knee joint (Seddon, 1939). The epitrochlear gland has been found

to be positive in wrist and elbow cases, while the inguinal gland is positive in ankle and knee cases and the external iliac gland positive in hip cases. This test was not used in this series.

*Acid-fast staining of pus* should always be applied. Guinea-pig inoculation is a more delicate test, but the smear is quicker and gives evidence of value relative to bacteria present. This was applied in 2 of our cases.

*X-ray examination of the joint* is absolutely essential. This usually discloses the typical reaction of bony destruction without new bone formation. This is a late sign of bone tuberculosis. Just as in early osteomyelitis due to pyogenic bacteria, so in early tuberculosis of bone, no changes are seen in the bone. The writer has seen a number of cases of his own, as well as other men's cases, in which the x-ray examination of the painful joint did not show any changes for a period of 2 to 5 months after the onset, but later developed the typical changes. Usually, antero-posterior and lateral views of the joint are taken. Skiagrams were taken in 73 of the present series.

*Biopsy of the joint* is mentioned with a word of warning. It is rarely used and only after all other diagnostic measures have been exhausted as danger of secondary infection and persistent draining sinuses is great. This is not true if sinuses already exist. As tuberculosis of bone is considered as always secondary to pulmonary, gastro-intestinal or gland infection, other tests of value should always be applied to find the primary focus.

*Sputum examination with guinea-pig inoculation* should be performed on all cases of bone tuberculosis. This was done 15 times in these cases.

*X-ray examination of the chest*, either fluoroscopic or by plate, should be done in every case as a majority of bone cases have pulmonary infection. Cave reported that 60 per cent of 122 children with tuberculosis of the spine had pulmonary infection. This test was performed 16 times in this series and 4 cases of pulmonary infection discovered.

*Excision of a gland with histological study and guinea-pig inoculation* where primary glandular infection is suspected is the only certain method of diagnosis.

*Stool examination* may be of value, but in a minority of cases, as contamination with the smegma bacillus is common in the stool, and the usual clinical history of diarrhoea and tenesmus gives a definite lead. Stool examination was performed in 50 cases.

### Clinical history

*Pain* is the outstanding symptom in tuberculosis of bone. Early in the course of the disease, pain is insidious and irregular and may only be noted as slight limitation of movement but it is progressive until it becomes constant.

*Trauma* may be associated with the onset of the pain, in the mind of the patient. In 44 cases or 25.1 per cent in this series a definite history of injury was obtained.

One joint is practically always involved in the process. One should seriously question a diagnosis of tuberculosis of multiple joints, unless the condition is limited to the bones of the wrist, hands, ankles or feet. In the present series 4 cases of spinal tuberculosis had infection in other bones (2 elbow; 1 hip; 1 foot); 2 cases of hip tuberculosis had infection in other bones (1 knee; 1 elbow); one case had tuberculosis in the wrist and ankle; therefore a total of 7 cases or 4 per cent had more than one joint involved.

*Muscle spasm* is almost always present when the pain becomes constant. It is only an effort on the part of the body to splint and protect the joint from motion.

*Cool swelling* may form and is frequently associated with a 'cold' abscess. This is a late sign of tuberculosis wherever it occurs. Very occasionally a tuberculous joint may be quite warm and associated with fever and marked leucocytosis. In these cases the tuberculin test, aspiration of joint contents, and other studies give the correct diagnosis. Five patients or 2.8 per cent of all spinal cases came with abscess unruptured. Others had draining sinuses from ruptured abscesses.

*Age of the patient* is a factor of importance. Tuberculosis is a disease of cancellous bone which is the characteristic bone of youth. In the present series, 42 were in children, 15 years or under, 88 aged 15 to 30, 40 aged 30 to 50, and 5 patients were over 50. Thus 130 cases or 74.2 per cent occurred under the age of 30.

*Sex* is not a factor of importance; 95 occurred in males and 80 in females.

*Location of the lesion.* In this study 68 involved the spine of which 6 were cervical, 42 thoracic, and 20 in the lumbar area. The hip was involved in 35 cases of which 17 were in the left and 18 in the right hip. The ankles were involved in 23 cases, knees in 19, elbows in 9, sternum in 5, wrists in 4, ribs in 4, foot in 3, and sacro-iliac joint in 1 case. This is an unusually high number of infections of the sternum, and these cases are being reported in detail elsewhere.

*Duration of the disease* was fairly long with an average for the group of 14 months. More important than the duration is the stage which the disease has reached in the individual case. This is best illustrated by the complications present.

*Complications.* Fifty patients or 28.8 per cent came with draining sinuses some of which developed spontaneously; many followed operations by doctors who in their ignorance had incised and drained a tuberculous joint because pus was present. A tuberculous joint which is drained will certainly become infected and continue to drain for months. Thirteen patients

came with contractures and 18 came with ankylosis, usually in a poor position. Of the spinal cases, 11 came with abscesses 6 of which had ruptured; 7 had paralysis of the legs; 4 had incontinence of urine or faeces or both; 17 had kyphosis; and 3 had scoliosis. Thus, it is seen 123 or 70.3 per cent of the 175 cases came to us with rather far advanced stages of bone tuberculosis and presenting complications, most of which are preventable if the disease is diagnosed early and proper treatment given.

### Treatment

The best treatment of tuberculosis is, of course, prevention. Isolation of contacts and education of the public is greatly needed.

The treatment of tuberculosis is rest—complete and prolonged rest—plus a building up of the body's natural defences by diet of high-vitamin high-calorie variety combined with heliotherapy in chosen cases. If the disease is in the spine or lower extremity, the patient must be recumbent as weight-bearing will not permit rest, no matter what type of brace or cast is used. Rest must be mixed with intelligence, as the end-result of all bone tuberculosis is usually ankylosis. Deformities must be prevented and the joints placed in the position of election for the type of work the patient concerned is doing.

Deformities already present are overcome by traction and extension. Abscesses are aspirated through normal tissue to prevent secondary infection taking place. Tuberculous abscesses should never be drained unless secondary infection and sinus formation have already taken place. Abscesses should never be permitted to rupture as secondary infection invariably takes place. If aspiration will not control the abscess, it may be opened, its contents evacuated, and sutured again but never drained.

*Surgery* is useful to a limited extent in tuberculosis of bone and is based upon two quite different principles. Surgical procedures are best confined to adults and the disease must be in a quiescent stage for the operation to be of benefit except in cases of amputation.

The first principle upon which surgery is based is that of splinting the diseased area and so providing rest to the part. This is the basic principle of the Hibbs and Albee spinal fusion operations and of fusion of any other joints. This is by far the most useful type of surgery in tuberculosis of bone and joints. In children, the same results can usually be obtained by prolonged immobilization without injury to the bone during the growth period and without danger of wide dissemination of the disease by the operation itself.

The second principle upon which surgery in bone tuberculosis is based is excision of the diseased part. Again its use should be confined to adults alone. This may take the form of amputation of an extremity or excision of a

joint or excision of the diseased bone. The excision of joints before the epiphyseal centres have become thoroughly ossified is to be severely condemned on the grounds :—

- (a) of interference with growth which produces a needless life-long deformity;
- (b) that immobilization for a prolonged period of time will produce as good or better results;
- (c) the economic factor does not loom as large in the life of a child as in an adult.

In the present series 17 operations (10 resections; 5 amputations; 2 spinal fusions), 32 incision and drainage of already infected joints, and 8 aspirations of abscesses were done. Seven deaths occurred in these 57 procedures, a mortality of 12.2 per cent. In many cases surgery may be delayed too long. If after 3 months of intelligent and careful treatment in adult cases of bone tuberculosis, improvement judged by lower pulse, temperature, and less pain is not noted, surgical interference should be considered where amputation can be done. Spinal fusions will accomplish in 6 to 10 months what it takes nature to achieve in 5 to 6 years and will usually prevent deformity, but it must not be used until the lesion has started to heal. Spinal fusion operations are rarely done on children at the present time.

In 109 cases no treatment other than application of plaster casts, sunlight, and high-vitamin high-calorie diet was given. Four deaths occurred in this group, a mortality of 3.6 per cent. Nine patients refused the treatment advised.

#### Summary

1. Tuberculosis of bone is a disease of young life, 74.2 per cent occurring under 30 years of age.
2. Out of 175 cases, 123 or 70.3 per cent came with far-advanced bone tuberculosis and presenting complications most of which are preventable if the disease is diagnosed early and proper treatment given.
3. Diagnostic methods have been pointed out.
4. Indications for surgical interference are reviewed.

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## THE IMPORTANCE OF A STANDARD IN EXAMINATION FOR TUBERCLE BACILLI

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In the *Report on the Classification of Pulmonary Tuberculosis* published by the Tuberculosis Association of India (1940), a plea is made for the recognition of a definite standard in the examination of sputum for tubercle bacilli, both on the admission and discharge of patients.

The minimum standard suggested for declaring a patient negative is that on discharge no tubercle bacilli should be found in smears on 4 successive days in 3 successive months, but it is recommended that whenever possible concentration tests and cultures should be made of the sputum and also of the stomach-wash water.

#### Technique

The following is a review of the work done on a series of patients in the Union Mission Tuberculosis Sanatorium, Arogyavaram. The routine examination on admission has been :—sputum examination by smear method on four successive days if negative and using picric acid counter stain, followed by concentration and culture on Jensen-Lowenstein's medium using 6 per cent sulphuric acid for homogenizing and destroying secondary organisms; stomach washes were also done on a number of patients negative by other methods. Cultures were examined for a minimum period of 6 weeks, the majority being examined up to a period of 8 weeks.

On discharge, the routine has been to examine patients who have been negative by direct smear for 3 months by concentration method and sputum culture and in a few cases by stomach-wash culture also.

#### Material examined

The review covers all the patients who were admitted to the sanatorium from 1st April, 1940 to 31st March, 1941, numbering 442 together with 214 patients admitted before 1st April, 1940, but discharged from the sanatorium during the year ending 31st March, 1941, making a total of 656 patients examined on admission.

Examinations for tubercle bacilli on discharge from the sanatorium are reviewed for all patients discharged during the year ending 31st March, 1941, and those admitted during that year and discharged before the date of writing (20th June, 1941).

The classification of the patients according to diagnosis and the stage of the disease is shown in table I.

For the purpose of analysis there are omitted the patients who stayed too short a time,

TABLE I

Diagnosis			Number of patients
Pulmonary tuberculosis	Stage I	..	44
	Stage II	..	57
	Stage III	..	462
Non-pulmonary tuberculosis	Abdominal and intestinal.	..	6
	Glandular	..	5
	Bone	..	2
No active tuberculosis and non-tuberculous diseases.			75
Patients who stayed too short a time for full examination and diagnosis.			5
TOTAL			656

and those who were diagnosed as not suffering from active tuberculosis or as suffering from non-tuberculous diseases such as bronchiectasis, lung abscess and asthma, although a good many examinations by smear and cultures were involved for the 75 patients included in this group.

It will be seen that 563 patients were diagnosed as suffering from pulmonary tuberculosis and 13 from non-pulmonary tuberculosis.

#### *Examination for tubercle bacilli on admission*

Taking first the 563 patients who were diagnosed as suffering from pulmonary tuberculosis, we find the result of sputum and stomach-wash examinations as follows (table II):—

TABLE II

#### *Examination for tubercle bacilli on admission*

	Stage I	Stage II	Stage III	Total
Number of patients	44	57	462	563
Tubercle bacilli found—				
None by any method.	33	20	25	78
1st smear ..	2	12	368	382
2nd smear ..	..	6	33	39
3rd smear ..	..	4	6	10
4th smear ..	..	4	7	11
5th to 13th smears	..	1	5	6
Concentration ..	1	..	3	4
Sputum culture ..	5	9	14	28
Stomach-wash culture.	3	1	2	6
By any method ..	11	37	438	486

In addition to the results given in table II, stomach-wash cultures were positive in 3 stage I, 3 stage II and 2 stage III patients in whom sputum culture was also positive.

In the group of patients found positive in smears subsequent to the 4th smear, one patient on admission showed numerous acid-fast bacilli in the stools, one patient acid-fast bacilli in a stomach-wash smear, two patients acid-fast bacilli in the pleural fluid; in one patient a sputum culture and in one patient both a sputum culture and a stomach-wash culture taken soon after admission showed no growth, but positive direct smears were obtained in the second or third months.

It will be noted that after the examination of direct smear on four consecutive days only 4 of the total of 486 positives were found by the concentration method used.

From table II it will be seen that 8 out of 11 positives in stage I patients were obtained by culture methods, 10 out of 37 in stage II patients, and 16 out of 438 in stage III patients.

In stage I, of 41 patients found negative by direct smear and concentration methods, 8 or 19.5 per cent were found positive by culture; of 30 patients in stage II 10 or 33.3 per cent, and of 41 in stage III 16 or 39 per cent.

#### *Consideration of negatives on admission*

The question now arises why, especially in stage III, are there any negatives at all. Are there explanations for the negative findings and have proper examinations, i.e., the full routine, been carried out, because while there may be an ideal routine, it may not always be possible to carry it out in every patient for various reasons? In table III are shown the examinations carried out on admission for the patients in whom no tubercle bacilli were found:—

From table III it will be seen that only 5 of the patients in whom no tubercle bacilli were found had neither a culture of the sputum nor stomach-wash culture or smear.

Of the patients in stage I with smears only, one stayed too short a time for complete examination, and two had a positive stomach-wash examination in this sanatorium some time previous to admission; in one stage III patient the sputum culture on admission was contaminated, but a later culture was positive.

In stage II patients grouped under 'others' two had mainly a glandular condition in one of whom tubercle bacilli were found in pus from a gland, and one had mainly an intestinal tuberculosis.

In stage III patients grouped under 'others' one had a tuberculous abscess (in the pus of which tubercle bacilli was found) and one was pregnant which affected the staging of the patient (i.e., the patients were not stage III by lung condition), one had a contaminated culture on admission but a later culture was positive;

TABLE III

*Examinations made of patients in whom no tubercle bacilli were found on admission*

	Stage I	Stage II	Stage III	Total
None found by any methods .. ..	33	20	25	78
Patients with pleurisy as the main or a prominent symptom.	8	7	9	24
Sputum and stomach-wash culture ..	2	5	3	10
Sputum culture and stomach-wash smear (stomach-wash culture contaminated).	4	1	..	5
Sputum culture .. .. .	..	..	3	3
Stomach-wash culture .. .. .	2	1	2	5
Smears only .. .. .	..	..	1	1
Patients arriving with A-P .. ..	..	2	8	10
Sputum and stomach-wash cultures ..	..	2	3	5
Sputum culture .. .. .	..	..	4	4
Stomach-wash culture .. .. .	..	..	1	1
Others .. .. .	25	11	8	44
Sputum and stomach-wash cultures ..	16	7	6	29
Sputum culture and stomach-wash smear	3	1	..	4
Sputum culture .. .. .	3	3	1	7
Smears .. .. .	3	..	1	4

two patients who had sputum and stomach-wash cultures negative on admission had positive direct smears in the fourth month.

It will also be seen that of the patients in whom no tubercle bacilli were found on admission, 24 came with pleurisy which was either the main symptom or which in most of the stage III patients had caused a collapse of the diseased lung, and 10 patients came with A-P. In stage III patients, there were only three in whom there was no explanation of any kind why no tubercle bacilli could be found on admission in spite of sputum and stomach-wash cultures.

No tubercle bacilli were found in the sputum or stomach wash of the 13 cases of non-pulmonary tuberculosis, although sputum and stomach-wash cultures were done in 4, sputum cultures in 3, stomach-wash cultures in 4, and smears only in 2. Tubercle bacilli were found in pus from two of the patients with glandular tuberculosis.

#### *Examinations for tubercle bacilli on discharge*

Turning now to the examination for tubercle bacilli on discharge of patients diagnosed as suffering from pulmonary tuberculosis, we find the results as given in table IV.

TABLE IV  
*Examination for tubercle bacilli on discharge*

	Stage I	Stage II	Stage III	Total
Number of patients	40	48	329	417
Tubercle bacilli found—				
None by any method.	34	36	123	193
1st smear ..	2	6	174	182
2nd smear ..	..	..	17	17
3rd smear ..	..	..	3	3
4th smear ..	..	1	4	5
Concentration ..	..	..	..	..
Sputum culture ..	3	5	7	15
Stomach-wash culture.	1	..	1	2
By any method ..	6	12	206	224

N.B.—If a patient stayed less than 1 month in the sanatorium, the examination on admission is taken as the examination on discharge.

From table IV it will be seen that 4 out of 6 positives in stage I patients were obtained by culture methods, 5 out of 12 in stage II and 8 out of 206 in stage III.

Of the 38 patients in stage I classed as TB-negative by direct smear and concentration test 4 or 10.5 per cent were found positive by culture; of 41 patients in stage II 5 or 12.2 per cent and of 131 patients in stage III 8 or 6.1 per cent.

#### Consideration of negatives on discharge

The question arises again, as with patients on admission, what was the standard of examination for patients discharged as TB-negative? The examinations carried out are shown in table V.

frequently longer periods went before a control culture.

It is found in the series of patients discharged that the following showed positive cultures:—

Period of negative direct smears	Number of patients' sputum cultured	Number of patients with positive culture
3 months ..	68	21
4 months ..	29	7
5 to 6 months ..	27	10
7 to 8 months ..	11	2
9 to 10 months ..	7	3
Over 12 months	2	2

N.B.—Many of the patients had subsequent negative cultures after the first culture but these are not included here.

TABLE V

*Examinations made for patients discharged as TB-negative*

Examination	Stage I	Stage II	Stage III	Total
Number of patients .. .. .	34	36	123	193
Sputum and stomach-wash cultures .. ..	2	3	4	9
Sputum culture .. .. .	7	16	101	124
Stomach-wash culture .. .. .	3	..	1	4
Stomach-wash smear (culture contaminated) ..	..	1	..	1
Concentration (culture contaminated) ..	..	..	3	3
Smears only .. .. .	22	16	14	52

Of the 52 patients who were discharged as sputum TB-negative on the result of smear examinations only, all except 3 stage II and 7 stage III patients were sputum TB-negative on admission. Many of these patients stayed only a short time and sputum and stomach-wash cultures made on admission were not repeated on discharge. Other patients left at short notice before sputum for cultures were obtained.

Of the patients discharged with sputum culture negative 42 had two negative cultures, 10 three negative cultures and 1 five negative cultures.

Of the 12 patients discharged who were suffering from non-pulmonary tuberculosis, the sputum was cultured in 1 only and was negative; in the others, smears were negative.

#### Cultures during treatment

It has now become the routine in this sanatorium to culture the sputum when a patient has had four negative direct smears in each of three consecutive months. This is the minimum period advocated by the *Report on Classification*, for a patient to be discharged as 'sputum negative'. In the earlier patients under review

A single culture may not be enough; for example one patient had 3 negative cultures followed by a positive culture and 63 negative direct smears; another had 2 negative cultures followed by a positive after 48 negative smears.

A negative culture is also not a guarantee that tubercle bacilli may not be found afterwards by direct smears. We have seen a patient with a negative culture after 5 months of negative smears who had a positive smear two weeks after the culture was made and several others have shown a positive smear one to three months after a negative sputum culture. In some cases exacerbation of a tuberculous focus has been the reason for the re-appearance of the tubercle bacilli in direct smear; in others there was no apparent explanation.

In three cases we have had a positive smear from centrifuged sediments, part of which has been cultured and the cultures have shown no growth.

#### Examination of stools for tubercle bacilli :

Examination of the stools by direct smear for tubercle bacilli has been carried out in 280 of



the patients diagnosed as suffering from pulmonary tuberculosis. Owing to the present difficulty of procuring stain this examination has been stopped. The following results were found :—

Sputum direct smear	Stools direct smear	Number of patients
+	+	157
—	—	80
+	—	34
—	+	9

Of the nine patients showing acid-fast bacilli in the stools and not in the sputum smears, 8 showed tubercle bacilli on culture of the sputum or stomach wash.

In two cases one diagnosed as 'no active tuberculosis' and one 'probable cancer', a few acid-fast bacilli were found in the stool smears. Whether they were tubercle bacilli is impossible to say, but it must be remembered that acid-fast saprophytes may be found in the stools.

#### Discussion

A review has been made of the results of examinations for tubercle bacilli for a series of 563 patients admitted to the sanatorium and found to be suffering from pulmonary tuberculosis and of 417 patients discharged from the sanatorium, keeping in mind the standard of examination advocated by the *Report on Classification of Pulmonary Tuberculosis* published by the Tuberculosis Association of India.

From table III it will be seen that the standard of examination by culture methods where bacilli could not be found by direct smear and concentration methods on admission was attained. From table II it will be seen that the great majority of positive findings in stage III patients was, as was to be expected, in the first direct smear, 368 out of 438 positive. Subsequent smears added 51, concentration smears added 3, and cultures added 16. In an examination of the 25 stage III patients in whom no tubercle bacilli could be found either by smear or by culture, an explanation of the reason for this was found in all except 3 patients, pleurisy and artificial pneumothorax before admission being the principal reasons. That is, culture methods have brought up the positive findings in stage III patients to over 99 per cent on admission (unless there is some special explanation for a negative finding).

In stages I and II the increase of positive findings by using culture methods is very marked, 8 of 11 in stage I patients and 10 of 37 in stage II patients being found by these methods. Especially in stage I patients the finding of tubercle bacilli is of particular importance from the point of view of diagnosis.

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### A MUNICIPAL SCHEME FOR TUBERCULOSIS CONTROL

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MADURA CITY is one of the largest cities in south India with a population of 182,018 in 1931 and an estimated population of 235,000 in 1941. It is an important place of pilgrimage and a big commercial centre with large spinning mills.

On a strict calculation, with the health officer personally verifying the deaths in every instance, 327 persons died of pulmonary tuberculosis during 1939. The average number of annual

(Continued from previous column)

The examination of direct smears on the third and fourth days while not adding very many to the total number of positives, is yet justified from the point of view of saving of labour, expense and time, involved in culture methods.

It has been noted that very few positives were found by the concentration method.

One of the points to be remembered in considering the number found positive by concentration and culture methods is that the more efficient is the examination of direct smears, the less will be the positives found by these other methods.

On discharge of patients it is not quite so easy to attain the ideal standard as on admission. In table V it is seen that 52 patients discharged as TB-negative had direct smears only; of these 42 were TB-negative on admission when they had a full examination, but 10 who had been TB-positive were not controlled by culture before discharge. From table IV it will be seen that 17 of 224 positives, i.e., 7.6 per cent, were only found by culture. Again it is especially noticeable in the stage I and stage II patients how important is the culture method where 4 out of 6, and 5 out of 12 of the positives were found by this method.

One of the consequences of the introduction of culture methods has been that a number of patients are left under treatment longer, until the sputum is bacilli-free by culture.

The inadequacy of four negative smears in three successive months is shown by the number of positive cultures obtained in such patients.

An examination of the positive findings in stool examinations by the smear method, suggests that where culture methods are not possible, it is worth while to examine stool smears in patients with a sputum negative by smear method.

deaths during the previous 10 years was 446 which gives a mortality rate of 245 per 100,000 of the 1931 census population. The reduced death rate in 1939 can be ascribed partly to the rigid verification and partly to the welcome change in the attitude of the public towards tuberculosis, as shown by their increasing eagerness to submit to early diagnosis and proper treatment.

The city health department has launched a frontal attack on this disease since 1938 and this paper describes the foundation, the working and the difficulties of the scheme.

#### A. Foundation

The foundation of the municipal scheme for combating tuberculosis in the city of Madurai lies in the following fundamental facts:—

Tuberculosis is an infectious disease caused by the bacillus tuberculosis and must yield to prophylactic measures common to all infectious diseases. The ultimate responsibility for the control of tuberculosis must therefore rest with the very authorities responsible for other infectious diseases, *viz.* the local bodies and their health staff.

With nearly 5,000 cases of active tuberculosis in the town the problem calls for immediate action. The need for formulating a scheme that is eminently feasible and practical and which will secure our objects within a reasonable time will be apparent.

Poverty with its attendant evils, poor nutrition, bad housing, overwork and worry lowers the individual's resistance to tuberculosis as to all other infectious diseases. Bad housing is of special importance in the spread of tuberculosis in so far as it promotes close and massive infection from an open case in the household. We believe that if the bacillus of tuberculosis can be excluded, no degree of poverty can by itself cause the disease. Further, the eradication or even the mitigation of these social evils falls outside the sphere of work of the medical officer of health.

Climate can no longer be believed either to cure or even markedly to benefit the case of tuberculosis, though it may somewhat add to his comfort. The fact that the rich patient indulges in the luxury of a special climate cannot mean that such indulgence is essential to cure his less fortunate brother. Considering the large incidence of the disease, something urgent, something cheap and effective is needed to stop this waste of human life and so far as municipal schemes are concerned we are convinced of the truth in Batty Shaw's conclusion that 'the enormous expenditure of money on sanatoria should be stopped and instead money should be spent in providing every tuberculosis officer with the facilities of a local pulmonary hospital or institute equipped with the means for carrying out full clinical bacteriological and skiagraphic examination of the lungs and provided with

adequate number of beds for the carrying out (a) of the more rapid, more effective and less costly collapse method of treatment of pulmonary tuberculosis in its truly early stage and (b) for accommodating advanced invalids suffering from this disease near the homes which they should no longer occupy'.

Sanatoria are good institutions, necessary in one phase of this control programme but they have their limitations. They are costly and can deal with only a small number of cases and play only a small part in the active prevention programme. Their chief value is that they serve as good educative centres for patient and doctor alike.

An anti-tuberculosis scheme to be successful should harness the services of every institution and every individual who can help in the scheme. The co-operation of the private practitioner who sees many cases when they are still early is of paramount importance. Unless the best relationship exists between the practitioner on the one hand and the municipal health officer and the tuberculosis officer on the other, and unless the former is confident that he can obtain the free help of the latter officers and can continue to retain the case, the scheme cannot be worked smoothly.

The object of the scheme is to have complete information regarding every 'open' case, so that he may be rendered bacilli-free by treatment when that is possible, or isolated; as also to detect the 'contacts' with early signs so that they may be arrested from becoming open cases. Such knowledge of every open case and its contacts and their cure or isolation, so essential to the effective check on the disease, can only be obtained by combining field work with the really important elements of sanatorium-regime which can be successfully practised without planting the institutions far away from the homes of the patient.

#### B. The scheme

Based on the above desiderata, our work has chiefly been concentrated on the 'open' case and his contacts.

*Registration of cases.*—Section 56 of the Madras Public Health Act of 1939 reads as follows:—

'Every medical practitioner who in the course of his practice becomes cognisant of the existence of any case of tuberculosis in any private or public building other than a public hospital shall, if the case has not been already reported, give information of the same with the least practicable delay:

(a) in municipal areas, to the executive authority, the health officer or a sanitary inspector; and

(b) in non-municipal areas to the health officer, a health or sanitary inspector or the village headman.

*Explanation.*—In this connection medical practitioners include hakims or vaidyas, whether registered or not.'

Cards have been supplied to all practitioners in the city to facilitate notification. The city health laboratory offers the following diagnostic service entirely free of any charge.

1. Blood—(a) Microscopic examination for malarial parasites.

(b) Cultural examination for typhoid group of organisms.

(c) Serological tests—Widal's and Kahn's tests.

2. Stool—(a) Microscopic examination for intestinal parasites, such as *E. histolytica*, and the eggs of parasite worms.

(b) Cultural examination for pathogenic intestinal bacteria.

3. Sputum—Microscopic examination for tubercle bacilli.

4. Throat swabs—Microscopic and cultural examination for *C. diphtheria*.

5. Cervical or urethral smears—Microscopic examination for gonococcus.

These aids should deter any practitioner from diagnosing a case of tuberculosis as one of malaria or enteric. The results of the laboratory examination of the sputum are turned to immediate use by way of instituting means for the prevention of the spread of tuberculosis. No fresh report of the case as required under the Public Health Act is demanded from the practitioner. Simultaneously, as the result is communicated to him, special intimation is forwarded to the division sanitary inspector. Apart from these living cases all deaths which are not certified by registered medical practitioners are carefully enquired into by the medical officers of the municipal dispensaries, and finally by the health officer.

*Detection of other cases.*—The contacts of each of these open cases or deaths from tuberculosis are examined regularly at the municipal tuberculosis clinic or in a few instances by the medical practitioners in attendance. The municipal tuberculosis clinic, started in December 1938, is at present located in the office of the city health department. The work of examining the contacts is greatly facilitated by the municipal ambulance going round to fetch the contacts. All the contacts are Mantoux-tested as also examined clinically. The contacts who are suspected of having any active disease are x-rayed. Since the outbreak of the war, however, to economize in films such cases are being screened in the first instance and only those suspected as having lesions requiring treatment are later x-rayed.

Many modern authorities would insist that every positive tuberculin reactor should be x-rayed, as the x-ray furnishes the most definite picture of the early lesion. The expenditure involved is however beyond our means. Hence a judicious selection of cases needing skiagraphic examination is made by the clinical examination including careful records of personal and family history. To date 1,602 persons being contacts of 284 'open' cases, have been examined.

*Provision of beds.*—With reference to the provision of institutional treatment of cases

suitable for collapse therapy, the city council with its characteristic acumen readily realized the need for a hospital and at its special meeting on 25th February, 1939, passed a resolution signifying its desire to construct and maintain a tuberculosis hospital at a capital cost of Rs. 50,000 and recurrent expenditure of Rs. 10,000 per annum. In view of the inevitable delay in building the hospital and the urgent need for the provision of more tuberculosis beds than are now available in the city, the municipality has, on 29th March, 1940, further resolved to pay for the maintenance of 8 tuberculosis patients at the local American Mission Hospital.

There are thus about 40 free tuberculosis beds between the government hospital and the mission hospital besides the paying accommodation that may be available in certain private nursing homes. To those who doubt the importance of this and further provision of beds we can do no better than draw their attention to the following words of Dr. C. Frimodt-Møller :—

'In the West the tuberculosis clinic is one of the most important links in the whole campaign but in India the money spent on tuberculosis clinics is often out of all proportion to the value derived from them. The reason for this is that they are sometimes established in towns without any facilities for treatment in hospital or sanatorium of patients for whom ambulant treatment is unsuitable. With the severe type of tuberculosis found in India, ambulant treatment is not only impossible for the majority of patients but is actually a danger to them and through them to their surroundings.'

A site has been chosen for the Municipal Tuberculosis Hospital on the outskirts of the city with easy access to the heart of the city. The municipal water supply and electric supply can be made available to the hospital without much expenditure. The site will, in short, fulfil all the desiderata necessary for a tuberculosis hospital near a city (*vide* Cummins, 1939).

*Organized home treatment.*—Such of the cases as are not suitable for any form of collapse therapy or have been discharged from institutions after a period of treatment are included in the scheme for organized home treatment which has been fully explained in the following circular letter to all the practitioners sent out on 12th December, 1939 :—

'You may be aware of the city health department's anti-tuberculosis campaign. The surveys carried out during the last 12 months have shown that in Madura city there are about 5,000 active cases, many of whom are disseminating tubercle bacilli, needing treatment and control. We desire to reach as many of them as possible and take adequate steps for their personal treatment and against their being dangerous to the community. We realize that the success of any such scheme depends entirely on your kind co-operation. You can help in the following ways:—

1. Send the sputum of all suspected cases to the city health laboratory, for a free report.

2. Any help you desire to have in the diagnosis or the treatment (as induction of pneumothorax, etc.) of your indigent patients can be had at the tuberculosis clinic temporarily located in my offices on any Tuesday between 3 and 4 p.m. You can have the free advice

of the clinic and continue to retain the case under your treatment.

3. There are a large number of poor patients who have perforce to be under organized home treatment. They will be given detailed advice regarding their treatment, mode of living, etc., after personal inspection of their homes by the clinic doctors. They would however require frequent supervision to give them symptomatic treatment, to keep a strict control over their isolation and sputum disposal, etc. It is proposed to request each practitioner to look after a few cases near his residence or consulting room. This supervision will have to be done in an entirely honorary capacity at present but it is hoped that with the formation of a care and after-care committee and the collection of funds it will be possible in time to offer a small fee for these visits.

If you are willing to co-operate please sign the enclosed note and return it very early to facilitate the proper organization of home treatment of these poor unfortunate fellow citizens in their and our interests alike.

Thirty-seven doctors have given their consent for co-operation in the scheme. At a meeting of the district medical association the exact rôle of the private practitioner in the organized home treatment of the domiciliary case has been further explained and discussed.

*Survey and propaganda.*—Apart from tracing out and examining the contacts of cases, the municipal tuberculosis clinic has also carried out an intensive house-to-house survey in the 28th ward. In connection with the survey a public meeting was arranged to explain the scope of the survey and the means for the control of the spread of tuberculosis. Several councillors including the chairman and vice-chairman and the district medical officer and other prominent medical officers were present. Notice of the meeting was furnished to every householder in the area it is proposed to survey through individual contact by the sanitary inspectors and the conservancy peons in the city. The result was highly gratifying in that the meeting was attended by more than 3,000, out of the total population of 10,000 in the area and among these there were not less than 400 women.

The effects made on this behalf were repaid by the most ready and hearty co-operation of the residents in the area included in the survey, proving the well-known principle that the most effective health education is that which is linked up with a practical programme for the control of any disease and an exposition of the rôle that each member of the community, the public health official, the council and the state have respectively to play in the furtherance of that programme. Nine hundred and eighty-six persons were included in the survey and the disease incidence rate in this area was found to be 2.23 per cent.

*Socio-economic studies.*—Apart from the medical examination careful enquiry has also been conducted into the housing conditions and the economic status of each family. Four hundred and fifty-five families in the house-to-house survey and 410 families in the contact survey have thus been completely investigated from

both aspects of tuberculosis—the contagious and the socio-economic.

We have thus records of great interest to the public health worker, the tuberculosis physician and the economist alike. We propose to submit them to a rigid statistical enquiry and to publish the results in due course.

The information obtained from the survey of the housing conditions has been put to immediate use by the issue of notices for effecting improvements and removal of defects. Such improvements do not usually cost much but are of great value in the home treatment scheme.

### C. Difficulties

Having given a brief idea of our scheme and the beliefs underlying it, let us now recount some of our difficulties in working out the scheme.

*Notification of cases.*—Although section 56 of the Public Health Act applies equally to hakims or vaidyas, whether registered or not, those other than 'allopathic' practitioners and licentiates in Indian medicine seldom notify cases of tuberculosis. We obtain knowledge of these cases only after they die. Thus, valuable time for prevention—and the collapse-therapist will claim also for cure—is lost.

In dealing with an essentially prolonged illness like tuberculosis, one often notices how the interest of the individual clashes with that of the community. Take for instance teachers, domestic servants and workers in the food industry, who are most liable to hand on the infection to susceptible children, or consider tailors and mill workers whose working conditions are often prejudicial to their own ultimate recovery and to the safety of their colleagues. When we discover an open case in any one of the above groups how long can we keep him out of his job and how far are we justified in taking away his bread? When such a patient has improved with proper treatment what are the criteria on which he is to be sent back to work, bearing in mind his own chances of relapsing and the chances of his associates getting infected? The answer to these questions will vary with each occupation and with each patient; but so long as we have not the means of providing any financial assistance through well established 'care and after-care' committees, we cannot be unduly harsh on the individual patient in our effort to save the community. Indeed the community has no right to expect to be saved so long as it has not awakened to its responsibility in the matter. 'There can be no happiness for any one of us unless it has been won for all'.—Mahatma Gandhi.

A large number of open cases, most of them in a pitiable state of extensive bilateral affection, arrive in the city every day seeking admission in the local hospitals. They doubtless stay in different parts of the city for varying periods during which they must be disseminating, 'gratis and

(Concluded on next page).

# CERTAIN EPIDEMIOLOGICAL ASPECTS OF PULMONARY TUBERCULOSIS IN NORTHERN INDIA

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M.R.C.S. (Eng.), D.T.M. & H. (Lond.)

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and

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OBSERVATIONS on some epidemiological aspects of pulmonary tuberculosis, based upon an analysis of a thousand consecutive cases and a thousand radiographs studied at the Government Tuberculosis Institute, Madras, were made by Sanjivi (1939). India is a very big country—very often termed a sub-continent—and the various parts of the country show a vast variety of climates, diets, economic conditions of the people, industrial conditions and state of communications, etc.—factors which may influence the incidence and type of tuberculosis.

We have, therefore, attempted in this paper to put forward an analysis, based upon a study of the histories of 1,298 patients who out of 3,153 new patients attending the out-patients' department of the Rai Bahadur Amar Nath Tuberculosis Institute, Mayo Hospital, Lahore, in 1939, were diagnosed as cases of pulmonary tuberculosis on the basis of some definite evidence. The analysis has been done on lines similar to those followed by Sanjivi (*loc. cit.*). Though most of the figures given below relate to the patients who attended the Tuberculosis Institute in 1939, under one item (age incidence) corresponding figures about patients who attended the Institute in 1937 are also given because they were also available. A study of this factor was made by one of us (K.L.W.) in 1937, but the results were not published.

(Continued from previous page)

post-free', billions of tubercle bacilli. We have an idea therefore of impounding such patients outside the city limits and debiting their maintenance cost to the respective local authorities, following the practice that at present prevails in the case of antirabic treatment.

Finally, we propose to intensify our efforts to gain information about every active case in the city by further studies. Surveys of selected groups, such as contacts, mill workers, etc., are more likely to yield results than a random house-to-house survey. We hope that by a fruitful co-operation of the householder, the family physician and the different institutions in the city, who have all already shown their keenness to help, the mortality and the morbidity rates of tuberculosis will be definitely brought down in the next two years.

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TABLE I

Showing sex incidence, 1939: 1,298 cases

	Number	Percentage
Males .. ..	867	66.7
Females .. ..	431	33.3

TABLE II

Showing age incidence, males and females together, 1937: 1,233 cases

Age group	Number	Percentage
Less than 15 .. ..	99	8.0
15 to 24 .. ..	584	47.3
25 to 34 .. ..	360	29.9
35 to 44 .. ..	124	10.0
45 to 54 .. ..	50	4.0
55 to 64 .. ..	13	1.0
Over 64 .. ..	3	2.0

TABLE III

Showing males and females separately, 1939: 1,298 cases

Age group	Males	Percentage	Females	Percentage
Less than 15	38	3.0	41	9.7
15 to 24 ..	333	38.8	206	47.8
25 to 34 ..	286	32.9	113	26.2
35 to 44 ..	139	17.1	54	12.5
45 to 54 ..	52	6.0	11	2.5
55 to 64 ..	17	1.9	5	1.1
Over 64 ..	2	0.2	1	..

It will be noticed from the 1939 table that the maximum incidence for both males and females is between the ages of 15 to 24, but that the peak rises much higher amongst the females of that age period and then falls quickly. It does not rise so high in males in the age period between 15 to 24, but falls slowly during the later age periods. These figures, we may say, differ somewhat from those of Sanjivi in his analysis of Madras cases. The incidence amongst his cases was highest, 37 per cent among males between the ages of 25 to 34, but continuously high amongst females in the age periods between 15 to 24 and 25 to 34, being 37.06 per cent and 37.74 per cent respectively.

There is however one similarity in the results of the two analyses. The incidence amongst females is very high in the age periods between 15 to 24, though preponderatingly high in our figures. As most girls in Punjab are married at about the age of 15, this is the age period during which they undergo their first two or three pregnancies.

In the 1937 analysis, figures were not collected separately for males and females. This table however again shows that the maximum incidence of the disease is below the age of 25. Both the tables moreover show that the disease causes its maximum morbidity between the ages of 15 to 45, which means that the disease takes its heaviest toll from the wage earners. This fact stresses the importance of the disease as a cause of great economic loss to the country.

The 1937 table shows 5.2 per cent of the cases occurring after the age of 45, and in 1939, 8 per cent of the males and nearly 4 per cent of the female cases were met with after the age of 45. This means that the common belief in the minds of many general practitioners that the disease is extremely rare amongst older persons is unwarranted. The disease is comparatively less common at this age period, but, in view of the fact that there are millions in this country suffering from this disease, thousands of old people are amongst its victims. Moreover, if we keep in mind the fact that the total number of people alive in this country above the age of 50 is much smaller than the number below that age, a fair proportion of those alive after the age of 50 seems to be affected and the incidence amongst them is not really as low as a figure of 4 to 8 per cent suggests. The belief that the disease is rare amongst old people is prevalent because of the infrequent use of x-ray in the diagnosis of pulmonary tuberculosis, as the symptoms at this age period very often simulate bronchitis and asthma, and the physical signs are often absent as the result of coincident emphysema.

*Occupational incidence.*—Figures given below relate only to males, as almost all women do only domestic work and are not employed in any definite trade, industry, or occupation.

It will be noticed that the percentage of agriculturists is low, when compared with their great preponderance amongst the general population. They form nearly 70 per cent of the population of the province. No undue conclusion should however be drawn from this, as the hospital, being in a town, it is likely that it would be frequented relatively more by the town dwellers than by the agriculturists from the villages.

One point, however, is noteworthy. The incidence amongst certain occupations notably clerks, students and tailors is very high and especially in the case of clerks and tailors much higher than would be warranted by the proportion of the number of those following

TABLE IV  
Showing occupational incidence, 1939 : 867 cases

Occupation			
1. Unemployed (including the age of 15)	41	males below	110
2. Agriculturists	..	..	140
3. Merchants (shopkeepers and business men)	..	..	98
4. Clerks	..	..	87
5. Students	..	..	78
6. Tailors	..	..	40
7. Coolies and labourers	..	..	37
8. Peons and chowkidars	..	..	26
9. Domestic servants	..	..	26
10. Carpenters	..	..	25
11. Mechanics and blacksmiths	..	..	23
12. Drivers	..	..	22
13. Teachers	..	..	19
14. Cooks	..	..	12
15. Painters and artists	..	..	12
16. Masons	..	..	12
17. Sweepers	..	..	11
18. Shoemakers	..	..	11
19. Goldsmiths	..	..	10
20. Policemen and soldiers	..	..	10
21. Dispensers	..	..	7
22. Book-binders	..	..	7
23. Weavers	..	..	6
24. Barbers	..	..	5
25. Miscellaneous	..	..	33

N.B.—'Miscellaneous' is a collection of a number of occupations or trades. Those following any one of these occupations or trades did not number more than four in the series.

these occupations amongst the general population. Moreover the morbidity amongst people following these occupations is much higher than that amongst other occupations contributing to the general population numbers equal to any of these two occupations. One point is common to the above-mentioned three occupations. These people sit for the major portion of the day crowded together in one room. Both clerks and tailors moreover have to lead a sedentary life, sitting in a stooping attitude for the major portion of the day. Surveys carried amongst those following these occupations, i.e., amongst Lahore College and School students which number several thousand, amongst thousands of clerks in Lahore's numerous offices and in the tailoring shops of Lahore, might provide useful data. We may mention here that an analysis as regards this point of our records of the two previous years also has shown the preponderance of the disease amongst the people following these occupations, and a high rate amongst these people is not peculiar to the year under review but has been consistent, so far as the attendance at this institute goes.

The high incidence amongst domestic servants, cooks, peons and chowkidars, drivers and teachers is of special importance. These can very easily act as sources of infection, and may partially be responsible for the outbreak of cases in families which never had a case amongst them before.

The very low incidence amongst professional people such as doctors, lawyers, engineers and others following relatively lucrative trades



(they are included in the miscellaneous group in this series) may be due to the fact that the hospital is visited mostly by poor people, and that those who are well-to-do prefer to consult a private practitioner. So no conclusion about the incidence of the disease amongst such occupations can be formed upon an analysis based upon those attending a hospital.

*Urban and rural distribution.*—Table V shows the origin of 1,252 cases: 46 persons gave no definite address.

TABLE V

*Showing incidence as regards urban or rural areas: 1939*

	Number	Percentage
Cases coming from rural areas	390	31.1
Cases coming from semi-rural areas.	56	4.5
Cases coming from urban areas	806	64.4

Eighty-six per cent of the population of Punjab is rural but only 31.3 per cent of the cases come from rural areas. However this comparatively low incidence amongst the rural population, as deduced from the statistics of a hospital in Lahore, is likely to be fallacious. The remarks made by us in the above paragraph in connection with the apparent low incidence of the disease amongst agriculturists, apply even more strongly to this apparent low incidence in rural and semi-rural areas. The hospital being in the town of Lahore, more people from this town, as well as other neighbouring towns with easy means of communication with Lahore, are likely to visit it. In semi-rural areas were included cases coming from small towns with a population of 4,000 to 5,000. They are mostly small market towns and the life in them is mostly on the model of villages. The low incidence of the disease in such areas is only apparent and not real as the population living in such small towns forms only a small proportion of the total population.

*Mode of onset.*—The figures as regards the incidence of the first symptoms noticed by the patient are as follows:—

TABLE VI

*Showing first symptoms*

Symptom	Number	Percentage
1. Fever .. ..	478	37.3
2. Cough .. ..	335	25.7
3. Cough and fever .. ..	222	17.1
4. Hæmoptysis .. ..	123	9.4
5. Pain in chest .. ..	61	4.7
6. Pain in abdomen, or diarrhoea, or other abdominal symptoms.	41	3.1
7. Cold and influenza .. ..	25	2.0
8. Loss of weight and weakness .. ..	9	..
9. Hoarseness .. ..	4	..

It may be mentioned that out of these 1,298 cases, 544 suffered from hæmoptysis at some time or another—either at onset or later on during the course of the disease.

TABLE VII

*Showing duration of the symptoms at the time of visiting the hospital*

Period	Number	Percentage
1. Less than 1 month ..	28	2.2
2. 1 to 2 months ..	257	19.8
3. 2 to 3 months ..	178	13.7
4. 3 to 6 months ..	342	26.3
5. 6 to 12 months ..	257	19.8
6. Over 1 year ..	236	18.1

It may be mentioned that many of the patients, when they describe the duration of the illness, mention the period for which they have been ill during their present illness. They have often forgotten their previous attacks, especially if those have been merely of a catarrhal nature—so-called influenza—for they never considered them to be tuberculous in nature. Considered from this point of view, many cases giving a short history may really be suffering from the disease for a long time.

However, if we rely upon the onset as described by the patient it will be noticed that only 36 per cent visited the hospital during the first three months of their illness, and 18 per cent did not visit the hospital till their disease was of at least one year's duration. It may also be mentioned that more than 80 per cent were in an advanced stage (3rd stage—Turban Gerhardt) of the disease before they visited the hospital.

Many of these patients however had consulted private practitioners before coming to the hospital.

Quite a large number, especially out of those coming from the villages, had been under the treatment of vaidis or hakims before visiting the hospital.

The facts that only 2 per cent visited the hospital in the first month of the illness, and only 36 per cent during the first three months, and that 80 per cent cases were in the advanced stage before they visited the hospital, point to the urgent need of propaganda about the early symptoms of disease amongst the public and the necessity of educating the public about consulting a doctor early. Unless the latter point is stressed, simple propaganda about the early symptoms only might create a sort of neurasthenia when any one of the symptoms appeared, and not result in any benefit to the people, which can only accrue if the patients consult a doctor to find out whether the particular symptom is due to pulmonary tuberculosis or some other disease. Such propaganda is moreover necessary, because many patients, before the disease becomes advanced and the symptoms rather troublesome, rely mainly upon vaidis and

hakims. If they knew the importance of early diagnosis, when such symptoms appear they might come straight to the doctor. Of course we should also see that the standard of the training of doctors is such that they are able to diagnose the disease in the early stages, and that, when they are in doubt, diagnostic centres in the form of clinics are available for their aid. Wider facilities as regards x-ray examinations will of course be of great help in this connection and are in reality a necessity if cases are to be diagnosed early by the doctors.

*History of contact.*—History of close contact with a tuberculosis patient in the family or outside the family was available in 350, or 27.9 per cent of cases. That means that a large number, *i.e.*, 72 per cent, give no history of contact. As about 28 per cent however do give a history of contact, the disease is obviously more common amongst families in which a case of tuberculosis has already occurred. [The reasoning is not clear and the conclusion is unsound.—EDITOR, I.M.G.]

*Type of the disease.*—There is a considerable difference of opinion as regards the predominant type of pulmonary tuberculosis prevalent in India. While some workers are of the opinion that exudative lesions preponderate, or at any rate are more frequently met with amongst patients in India, than the productive ones, others think that the disease as seen in India is practically of the same type as seen in Europe, *i.e.*, that the productive type of lesions is common and accounts for the majority of cases. It may be that the disease differs somewhat in its characteristics in different parts of India. We are at present preparing detailed statistics on this point based upon an analysis of the histories and skiagrams of patients admitted into the Rai Bahadur Amar Nath Tuberculosis Institute, Mayo Hospital, during 1939, and propose to publish these in a subsequent paper.

In this paper, we propose to give an analysis based only upon an examination of x-ray skiagrams taken in the out-patients' department of the Rai Bahadur Amar Nath Tuberculosis Institute. Seven hundred and forty-six skiagrams were taken for the purpose of diagnosis and finding out the type and extent of the disease. Those who were suspected to be possible cases of pulmonary tuberculosis or some other lung disease, such as bronchiectasis, or those who on physical examination seemed to have tuberculous lesions amenable to collapse therapy, were x-rayed, but on account of the necessity of observing economy in expenditure those who had obvious extensive bilateral tuberculous disease were not skiagraphed. Out of these 746 cases 361 turned out to be non-tuberculous (cases of bronchiectasis, bronchitis, lung abscess, etc.), 39 had lesions suspicious of tuberculosis, but not definitely so and are not included in the analysis given below. The rest, *i.e.*, 346 skiagrams, showed definitely tuberculous lesions and are chosen for the analysis.

TABLE VIII

Showing nature of tuberculous lesions in 346 skiagrams

	Number	Percentage
I. Exudative .. ..	19	5.5
II. Mixed—		
(1) Predominantly exudative.	121	34.9
(2) Predominantly productive.	124	35.8
III. Productive .. ..	47	13.5
IV. Chronic fibroid ..	20	5.8
V. Pleural .. ..	15	4.6

Thus 40.4 per cent of the skiagrams showed exudative or predominantly exudative lesions, 35.8 per cent showed a mixture of the productive and exudative type with the former predominating and 19.3 per cent showed either a productive or a chronic fibroid type of lesion.

Sixty-eight cases, or 19.6 per cent had thick-walled cavities. Fresh soft cavities which were very frequent amongst the exudative and predominantly exudative cases have not been included in the list. It may be noted that the corresponding figure for thick-walled cavities in Dr. Sanjivi's analysis is practically the same, *i.e.*, 20 per cent and 12.9 per cent of his cases belonged to the chronic fibro-caseous and chronic fibroid types.

Other studies have however revealed markedly different figures. Dr. Benjamin's (1938) detailed analysis based upon a study of the skiagrams of 2,021 Indian patients admitted into the Union Mission Tuberculosis Sanatorium, Arogyavaram, after 1930, revealed the exudative type to be responsible for 93 per cent of cases and he found thick-walled cavities in only 5.9 per cent.

We must point out certain sources of error in our analysis. As we have already mentioned patients with very advanced extensive lesions were not x-rayed, because of reasons of economy. The majority of such cases were obviously chronic in type and had suffered from the disease for a long time before attending the hospital. A large percentage of them will show thick-walled cavities, and so, in our opinion, thick-walled cavities and other evidences indicating a chronic type of lesion would have been found in a much higher percentage if all cases could be skiagraphed.

We may point out that an analysis upon this question based upon cases in any sanatorium is likely to have many fallacies. Some sanatoria are expensive, and the majority of their beds are filled up by rich patients who may show a different percentage of certain types of lesions as compared with the general mass of the population. Other sanatoria and hospitals exert a marked selection when admitting cases, and are not likely to admit the very advanced chronic cases full of cavities, nor the very acute

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# LESSER KNOWLEDGE OF HUMAN TUBERCLE BACILLUS: SEROLOGICAL AFFINITY WITH ALLERGIC STATES, VARIATION IN CONTENT, ETC.

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THE intention is to draw attention to (i) a complement-fixation reaction of a very high order given by the sera of cases of leprosy and kala-azar with an extract of human tubercle bacillus, (ii) the greater extractable content of the local bacillus, and to make (iii) observations on the similarity and possible associations between tuberculosis, leprosy, kala-azar and syphilis, from an immunological point of view.

## Complement fixation in leprosy and kala-azar with an extract of human tubercle bacillus

Many workers going by the group relationship between *Mycobacterium lepræ* and *Mycobacterium tuberculosis* have fixed complement with sera from lepers and an antigen prepared from human tubercle bacillus, during the last 35 years (Eitner, 1906; Cooke, 1919; Lewis and Aronson, 1923; Taylor and Malone, 1924; Raëvsky and Braoul, 1926; Witebsky, Klingenstein and Kuhn, 1931; Brants, 1932; Kornel, 1933; Bier and Arnold, 1935; Rabello and Machado, 1936; Cerqueira and Pereira, 1936; Row, 1938). The writer using the antigen of Witebsky, Klingenstein and Kuhn (WKK antigen) has also evolved a satisfactory technique (Greval, Lowe and Bose, 1939; Greval, Chandra and Das, 1941). The antigen has now been prepared locally (Greval, Das and Sen Gupta, 1941).

(Continued from previous page)

cases. On the other hand, it must be admitted that many cases of the chronic type especially from poor and even middle classes not being able to afford any respite from their work excepting when it is absolutely enforced upon them, often prefer to get occasional treatment when necessary from the private practitioners, or as out-patients of the hospital rather than get admitted into any hospital or sanatorium. An out-patients' department of a hospital or a clinic is likely to supply more reliable data on this point than an analysis based on cases admitted in a hospital or sanatorium, though the latter have obviously got the advantage of supplying more comprehensive information, as detailed histories are available and prolonged observation is possible in such institutions. In my opinion, really reliable and decisive results on this question can only be obtained if a careful analysis is done of cases detected in some widely undertaken survey.

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In controlling the reaction with cases of other diseases a surprising fact has come to light, that the reaction with sera from cases of kala-azar is more constant and uniformly of a higher order than that with sera from lepers.

The degree of fixation of complement is comparable to that obtained in the Wassermann reaction of secondary syphilis. It is not likely to be missed or masked by any slight error or irregularity that is likely to creep into a serological procedure.

The antigen is essentially a solution in benzol of the alcohol-insoluble, pyridine-soluble and acetone-insoluble fraction of the human tubercle bacillus. Lecithin is added as a fortifying reagent. The benzol is evaporated and replaced by a much larger volume of saline.

## The greater extractable content of the local tubercle bacillus

The only difficulty encountered in preparing the antigen according to the original description given by its discoverers (Witebsky, Klingenstein and Kuhn, *loc. cit.*) was that the final acetone-insoluble residue did not dissolve in the quantity of benzol recommended. The quantity had to be increased 2 to 3 times. The potency and specificity of the preparation were the same as those of the imported preparation. The conclusion, therefore, emerges that the desired content of the bacillus must be 2 to 3 times the content found in Europe.

The cultures of the bacillus were grown in the laboratory of Dr. A. C. Ukil in the Institute of Hygiene and Public Health, Calcutta.

## Similarity and possible associations amongst leprosy, kala-azar, tuberculosis and syphilis, from an immunological point of view

**Leprosy and tuberculosis.**—The causative organisms of both the diseases belong to the same group. Does one of them sensitize a patient for the other? Is leprosy more likely to develop after the 'first infection' of tuberculosis? Is the reaction of the lepers' sera with WKK antigen a reaction of group specificity? Does a similar reaction occur in some cases of tuberculosis after the 'first infection'? Or is the reaction indicative of an allergic state in which the reacting substance, an 'auto-antibody' (like the substance reacting in the Wassermann reaction of syphilis), has been formed in the patient's system against his own tissue attacked, damaged and denatured by the organism (demoralized, after the technique of fifth columnists) but not destroyed (killed outright, after the technique of old fashioned invaders)? These questions are suggested by the reaction of the serum.

**Leprosy and kala-azar.**—The serum reactions with WKK antigen of both the diseases are identical. Is kala-azar too superimposed on the allergic state of tuberculosis? Or, again, is the reaction in kala-azar merely indicative of an allergic state producing an auto-antibody?

Why should the auto-antibodies produced in leprosy and kala-azar be identical and different from that of syphilis?

*Leprosy, kala-azar, tuberculosis and syphilis.*

—Both kala-azar and leprosy produce occasionally an auto-antibody like that produced in syphilis and are thus responsible for positive Wassermann reactions which are false (Greval, 1928; Greval, Sen Gupta and Napier, 1939). Eosinophilia with or without association with tuberculosis also occasionally produces an auto-antibody like that of syphilis (Greval, 1940). The association between eosinophilia and pulmonary tuberculosis, however, may be remote, if not fictitious (Frimodt-Møller and Barton, 1940).

*A speculation concerning mycotic infections.*—Do these infections, causative organisms of which are genetically allied to the mycobacteria, sensitize a patient for tuberculosis, leprosy or kala-azar? They and leprosy are favoured by similar meteorological conditions.

#### Summary

1. Sera from cases of leprosy and kala-azar fix complement with an extract from human tubercle bacillus.

2. The alcohol-insoluble, pyridine-soluble and acetone-insoluble fraction of the local human tubercle bacillus, responsible for complement fixation appears to be greater than that of the imported European bacillus.

3. The auto-antibodies formed in tuberculosis, leprosy, kala-azar and syphilis show associations, close and remote.

[Note.—Attention is drawn to a letter on page 637 of this issue on the subject of the specificity of the WKK reaction in leprosy.—EDITOR, I. M. G.]

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## A Mirror of Hospital Practice

### A CASE OF ETHER CONVULSIONS

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This case is of interest because ether convulsions appear to be a rare occurrence in this country, and we are not aware of a case having been recorded previously in any Indian medical journal.

At 1-45 p.m. on 22nd May, 1941, No. 3573 Pte. E. A., aged 19 years, was admitted to the Presidency General Hospital with the typical history and signs of acute mastoiditis of about a week's duration; there was a profuse pulsating discharge from an anterior perforation in the right drum, oedema of the roof of the external auditory meatus, and oedema of the mastoid process had pushed the pinna downwards and forwards. The temperature was 101.6°F., pulse 72 and respirations 24.

At 2-5 p.m. he was given an injection of atropine gr. 1/100 combined with inj. hyoscin. co. A (B. W. & Co.), and prepared for operation. At 2-45 p.m. anaesthesia was induced by chloroform and ether mixture, going on to ether by the open method. After about six ounces had been given in this way, a Boyle's apparatus was brought into use, and ether-oxygen mixture was given during the actual operation. A further two ounces of ether was expended in this way, making a total of about eight ounces for the whole anaesthetic.

The operation was begun at 3-0 p.m.; there was considerable oozing of blood from the operation area throughout the operation, pus escaped freely as the mastoid cells were opened, and exposure of the lateral sinus revealed granulations upon its wall. Work on the mastoid had just about finished when the patient went into a typical ether convulsion. The muscles of the face, arms and legs began twitching, the movements soon changing to clonic convulsions. Respiratory movements stopped, the pulse became soft, and it was noticed that the free oozing in the wound stopped and the tissues became cyanotic.

The flow of ether was stopped and a full dose of evipan successfully given in spite of the strong movements of the patient's arm. After five minutes morphia gr. 1/6 was given hypodermically. The convulsions

subsided after about another two minutes, and the patient's general condition became normal. The wound was dressed and the patient sent back to the ward at 3-45 p.m. After operation the temperature was 104.2°F., pulse 140, and respiration 30. At 10-0 p.m. the temperature was 101.6°F., pulse, 108, and respiration 24. Intensive sulphapyridine therapy was started on the same evening, and the patient's temperature and pulse rate became normal within 30 hours. Thereafter his progress was rapid and uneventful.

The operating theatre was equipped with a Frigidaire dehumidifier, and at the end of the operation the thermo-hygrometer readings were: temperature 84°F. and humidity 74 per cent. The readings at Alipore at 5-0 p.m. on that day were: maximum temperature 90°F. and humidity 76 per cent.

#### *The control of ether convulsions*

One of us (W.McN.N.) had previously seen three cases of ether convulsions in England. They were of equal severity to the case described, and were successfully controlled by the intravenous injection of morphia grain  $\frac{1}{4}$ .

The favourable report on the use of evipan by Bailey (1940) led us to try it in our case, and there was no doubt as to the success of this measure. The rapidity of its action appeared to be about the same as that of intravenous morphia, and it gave rise to no after-effects. It is hardly necessary to add that before intravenous drugs are tried the ether should be discontinued and oxygen, with 5 per cent carbon dioxide added, if desired, administered through an efficient airway. Also the degree of shock, always present in these cases, must be taken into account before intravenous therapy is used. To continue the anaesthetic with chloroform instead of with ether, as has been recommended in the past, is to court disaster. Hall (1940) issues this warning: 'It seems probable that more deaths have resulted from the various forms of treatment applied for this condition than for the condition itself'. Finally it should be remembered that only fresh ether should be used for anaesthetic purposes, and the ether chamber of all forms of anaesthetic apparatus emptied after use.

#### *Ætiology of ether convulsions*

The ætiology of this condition is still not fully understood. At least thirty-three factors have been suggested by various writers, some being contradictory (Lundy, 1937). The report of a case of ether convulsions accompanied by suggestions as to its causation seldom fails to stimulate a lengthy and often acrimonious correspondence on the subject (Pinson, 1927; Taylor and other, 1938; Nosworthy and other, 1937; Newton-Andrews, 1940; Logan, 1941).

The consensus of opinion seems to be that ether, or possible impurities in it, is not alone responsible for the condition. Some other factor or factors are associated. It is unjustifiable, on the strength of a single case, to try and prove that the infrequency of ether convulsions in India is due to the absence of any particular factors. But we suggest that two factors may point the way to solution of the problem.

One is that there is a difference in the relation between the patient's body temperature and local meteorological conditions in India, where ether convulsions are rare, and in temperate climates, where ether convulsions are more common. The other is that India is relatively ill-equipped with apparatus for the administration of closed or semi-closed anaesthesia, whereas these methods have been in fashion in Europe for about twenty years, coinciding with an increase in the incidence of ether convulsions.

#### *Summary*

(1) A case of ether convulsions, successfully controlled by the administration of evipan, is recorded.

(2) Factors are suggested to explain the rare occurrence of this condition in India.

Permission to publish this case was kindly given by Major G. B. Walmsley Fisher, I.M.S., Acting Surgeon Superintendent, the Presidency General Hospital, Calcutta, and by Captain V. M. Albuquerque, M.B.E., I.M.S., Surgical Specialist, P. and A. District.

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### A CASE OF IMPERFORATE EXTERNAL URINARY MEATUS

By A. C. ROY, M.B.

*Charitable Dispensary, Balagaria, Midnapore*

RECENTLY I was called to see a new-born male child who had not passed any urine since birth about 72 hours previously.

The baby was quiet and there was no bulging of the lower part of the abdomen suggesting distension of the bladder.

On examination no external urethral opening could be found. In the normal position of the external meatus a slight depression was present. The prepuce was short and curled up at the corona glandis. The glans penis was bare and not covered by the prepuce. No other abnormality was detected in the child.

A small incision was made along the depressed area and a thick membrane was incised and an opening was found. A fine rubber catheter was introduced through the opening and it went right into the bladder and about 2 drachms of high-coloured urine was drawn out.

The history of passage of urine *per anum* prior to operation could not be elicited. Therefore the existence of any communication between the bladder and the rectum could not be ascertained.

The baby is now perfectly well and is passing urine through the normal channel.

# Indian Medical Gazette

OCTOBER

## THE SPECIAL TUBERCULOSIS NUMBER

THIS month we are publishing our fifth special tuberculosis number. As in previous years we have received the help of a sub-committee of the Tuberculosis Association of India for collecting and selecting the articles for publication. All the original articles in this number have been approved by a committee consisting of Drs. C. Frimodt-Møller, the medical commissioner of the Tuberculosis Association of India, A. C. Ukil and B. K. Sikand, and all the matter forwarded by this committee has been included in the number. The committee wishes it to be known that approval for publication does not necessarily mean that they place their seal of personal or official approval on everything that has been written by the contributors or that they identify themselves with the views expressed, for they wish the number to be representative of expert opinion in India generally, not only of that of one body.

The outstanding feature of the year in the tuberculosis scene in India was the opening on 21st May of the Lady Linlithgow Tuberculosis Sanatorium, at Kasauli, by Her Excellency the Marchioness of Linlithgow, President of the Tuberculosis Association of India; thus has come true a dream that Lady Linlithgow has cherished since she launched her appeal for the King-Emperor's Anti-Tuberculosis Fund in 1937. A tuberculosis sanatorium with 112 beds will not solve India's tuberculosis problem, nor when it has expanded to its full scope of 250 beds will it be able to accommodate even one in ten thousand of the country's tuberculous subjects, but we should not be surprised if future medical historians did not single out this event as the real beginning of the solution of this terrible problem. The sanatorium is to be the centre in India for teaching and research in tuberculosis; both are urgently needed, perhaps the former even more than the latter.

## TUBERCULOSIS AS A PUBLIC HEALTH PROBLEM IN INDIA

TUBERCULOSIS is one of the most urgent public health problems in India. Although tuberculosis is by no means a new disease in this country, at no time in the history of India has it been so widespread and so devastating in its effects as it is at the present time. With the development of industries all over the country and the introduction of rapid

modes of transport, with the ever-increasing immigration of the people from the rural to the urban and industrial areas in search of work, and with the insanitary conditions and low standards of living that prevail, the disease has made rapid strides within the last two decades. It is now not only prevalent in most of the towns in India but also in many rural areas. It is estimated by some workers that there are over 3 million cases of tuberculosis in India and that not less than 5 lacs of people die of the disease every year. This may be an over- or an under-estimate, but the fact remains that the disease is responsible for enormous mortality and morbidity in the country.

All the provinces in India have a tuberculosis problem and its importance is in no way less than that of any other public health problem, with perhaps the single exception of malaria. In the past, tuberculosis was regarded as a disease more common in western countries than in India but to-day it causes more deaths in India than in any of the western countries. The total annual deaths from tuberculosis in the United States of America is only 80,000, in Great Britain 30,000, in France 67,000, in Italy 60,000, in Germany 56,000, but in India it is over 500,000. A comparison of the deaths from tuberculosis in a few of the important cities in India and elsewhere will further emphasize its public health importance.

### *Tuberculosis deaths per 100,000 population*

Paris	.. 177	Cawnpore	.. 432
Mexico	.. 170	Lucknow	.. 419
New York	.. 128	Madras	.. 290
Berlin	.. 120	Calcutta	.. 230
London	.. 96	Bombay	.. 140

Another very regrettable aspect of the tuberculosis problem in this country is that the disease collects the heaviest toll from the adolescents of both sexes—the period of increasing activity and usefulness. The economic loss to the country consequent on the illness and death is thus enormous. It is on account of the increasing morbidity and mortality from the disease that a profound interest is now being shown all over the country for fighting this great scourge of civilization.

In a campaign against tuberculosis, the first thing to be realized is that considerable sums of money are required to fight it successfully. For a country like India and for a problem of the magnitude of the Indian tuberculosis problem, several crores of rupees will be needed annually and improvements in diverse directions will have to be effected before lasting good can result. An idea as to the enormous sums of money required for successful control work can be gained from the table below which gives the amounts spent by some of the western countries on anti-tuberculosis measures during 1928.



	Deaths from tuberculosis	Number of fresh cases	Total cases	EXPENDITURE	
				Total	State
Germany ..	55,672	146,246	?	50 to 60 million marks	30 to 35 million marks
England ..	36,623	77,881	350,000	£3,013,530	£1,613,962
France ..	60,000	100,000	?	360 million francs	87 million francs
Italy ..	60,000	59,000	?	290 million liras	45 million liras
India ..	500,000	?	3,000,000	?	?

The question that naturally arises is how can India obtain the requisite money for her campaign against tuberculosis? In the western countries the money for anti-tuberculosis schemes has been obtained not only from the state's coffers but also from private sources. The latter in fact has been repeatedly shown to be the mainstay of all anti-tuberculosis schemes. So far as India is concerned voluntary contributions have not been forthcoming to the requisite extent. Even after the lead given recently by Her Excellency the Marchioness of Linlithgow in starting the King-Emperor's Fund, the response, though good, has not been as generous as it could have been. Until and unless private donations pour in freely from all sides it will not be possible for the state to draw up a definite policy or programme best suited to the needs of the country.

When the time for starting a comprehensive campaign comes, as it surely will some day, the following questions will have to be considered and properly answered before formulating any plan and putting it into operation:—

(i) What is the extent of infection and disease in the country, and what are the special factors that are responsible for the increase in tuberculosis? (ii) What are the causes of decline in tuberculosis mortality in other countries and how may the problem be tackled in India in the light of the experience of others? (iii) What is the minimum programme of administrative preventive measures to be adopted? (iv) How can funds be obtained for anti-tuberculosis schemes?

The answer to the first question can be given only by conducting proper tuberculosis surveys in all affected areas, as recommended by the Tuberculosis Survey Committee of the Indian Research Fund Association (1940). With regard to questions 2, 3 and 4, the League of Nations' inquiry (1932) into the prevention of tuberculosis has provided appropriate answers. Their conclusions can be summarized as follows:—

Tuberculosis has declined with advancing civilization and improved well-being. It can be measured in terms of the increase in the purchasing power of wages of earning members. It is directly correlated with better food, housing, cleanliness, sanitation and education. As tuberculosis is essentially a social disease,

anti-tuberculosis campaigns are amongst the activities of social hygiene. Administrative preventive measures must utilize for purposes of detection, isolation, disinfection, and treatment, special agencies such as legislation, dispensaries, hospitals, sanatoria, preventoria, school medical inspection and health insurance. The driving power for anti-tuberculosis work must come from the state. Money must be amply provided, not only from the state but also from private donations, special taxation and suitable schemes of health and invalid insurance. The state must act as the co-ordinating agency directing the entire scheme.

The report of the Public Health Commissioner with the Government of India for the year 1932 states:—

'The only organization solely concerned with anti-tuberculosis work in India is the King George's Thanksgiving Anti-Tuberculosis Fund. This organization is ill-equipped financially and is mainly concerned with propaganda work. It may as yet be said to have only engaged in preliminary skirmishes with its subtle enemy and it is difficult to see how it can do more, until ample funds are provided in every province. But it must be realized that the way to victory does not lie, except in small part, in the provision of clinics, hospitals and sanatoria. Money spent on such institutions will be money largely wasted unless the social factors involved are studied and then attacked with vigour. In the practice of more hygienic methods of living, in the provision of ample nutritious food supplies and generally in wider appreciation of the dangers inherent in harmful social practices, will be found the way to a gradual decrease of this scourge of civilization and generally to a healthier and happier people.'

From these quotations it will be clear that the main problem in tuberculosis is socio-economic, and the remedy lies not only in the hands of the state but also in the hands of the people. Solution of the socio-economic problem will not only help indirectly to reduce the incidence of tuberculosis, but also result in the reduction of many other preventable diseases.

K.

In announcing this special tuberculosis number, we included, in all good faith, Dr. C. Frimodt-Møller's name amongst the contributors. We were at the time unaware of Dr. Frimodt-Møller's sudden serious illness from which we are glad to be able to announce that he has now almost completely recovered. It is a matter of very great regret to us that this number will appear without a contribution from India's outstanding pioneer in anti-tuberculosis work.

## Special Article

### RECENT ADVANCES IN OUR KNOWLEDGE ABOUT VITAMIN B<sub>1</sub>

By N. C. DATTA

Assistant Professor of Biochemistry, Grant Medical College, Bombay

'CHEMISTRY has been of immense service to medicine and other biological sciences'. There has been an extension of knowledge in all its branches but in none have there been more spectacular discoveries than those in the field of biochemistry. Modern technique is effecting in quick succession the isolation and the synthesis of many of the accessory food factors more commonly known as vitamins. Many of these synthetic products have been put into medical practice and vitamin therapy has now been extended to all branches of the pathological field. It is, however, 'in the wider field of preventive medicine that the newer knowledge about the vitamins is proving of greatest value'.

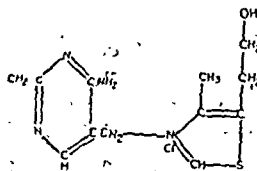
#### Isolation and identification of vitamin B<sub>1</sub>

Vitamin B<sub>1</sub> is the most well-defined constituent of the vitamin-B complex. The existence of this vitamin was suspected by Eijkmann nearly forty years ago when his classical researches on the relation between experimental polyneuritis and human beri-beri were in progress. The earlier researches of Eijkmann, Fraser, Stanton, and Funk showed that a substance was present in rice polishings which protected animals against disorders characteristic of beri-beri. Although the early attempts on the isolation of the anti-beri-beri substance were marked in many instances by over-enthusiasm, the search for the active constituent of rice polishings was destined to last for a quarter of a century owing to the inherent difficulty of the problem.

The chemical investigations on the isolation of vitamin B<sub>1</sub> led workers to believe that they were dealing with a comparatively simple substance. Funk (1911) isolated from rice polishings a crystalline substance which he believed to be the salt of anti-beri-beri vitamin. From a study of its properties he placed the compound in the class of pyrimidine bases, but before long fears were expressed that the compound was not pure but contaminated with a varying proportion of the vitamin. In 1926, the position was radically altered by the announcement that two of Eijkmann's successors in the medical service of the Dutch Indies, Drs. Jansen and Donath (1926), isolated from rice polishings a few milligrams of highly active crystalline hydrochloride of the free base having the formula C<sub>12</sub>H<sub>17</sub>ON<sub>3</sub>S. Most of the other workers who repeated the method of isolation described by the Dutch investigators were successful, wholly or in part, in confirming the essentials but failed to establish the purity of the crystalline hydrochloride.

A profound sensation was caused when Windaus and his associates (1931, 1932) at Gottingen obtained a crystalline material with practically the same potency but differing in chemical composition. Analytical results revealed the presence of sulphur in the compound having the formula C<sub>12</sub>H<sub>17</sub>ON<sub>3</sub>S. The presence of sulphur in similar products was confirmed and proof was adduced that the preparation of Jansen and Donath also contained sulphur. The serious differences in analytical results led one to suspect that all the preparations were not of uniform composition. The absorption spectra of various crystalline preparations strongly indicated that the best crystalline products were not homogeneous and that the vitamin had not been isolated.

A successful attack on the problem began with the work of Williams *et al.* (1930), who in 1935 developed a method for obtaining a consistent yield of the vitamin. They obtained approximately 5 grammes per ton of rice polishings which is about 25 per cent of the total amount present. A study of the chemical behaviour of the substance resulted in the elucidation of the nature of vitamin B<sub>1</sub> and eventually to its synthesis. It is now definitely known that the molecule of vitamin B<sub>1</sub> is built of the two-ring system, namely a pyrimidine ring and a thiazole ring, having the following structural formula:—



Vitamin B<sub>1</sub> is now made synthetically in the laboratory from simpler compounds and is prepared in quantities corresponding to thousands of tons of rice polishings at a price much cheaper than the natural substance in the pure state.

The extraordinary achievement of the chemists in effecting the decomposition of the vitamin isolated from rice polishings and then in building up a complex molecule from relatively simple organic compounds identical with the natural product having only 'the right atoms of the right elements in just the right places', is matter of admiration and furnishes an excellent illustration of the spirit of organic chemistry.

**Nomenclature.**—In the older literature, the term 'anti-beri-beri' or 'anti-neuritic vitamin' was most commonly employed. In more recent literature vitamin B<sub>1</sub>, aneurin (Jansen), or thiamin (Williams) are used. Aneurin seems to be the name preferred in Europe, whereas in the United States workers have adopted the name thiamin.

**The principal effects of vitamin B<sub>1</sub> deficiency.**—Animals deprived of vitamin B<sub>1</sub> show a number of symptoms of disordered function. Our knowledge about the nature and symptomatology of vitamin-B<sub>1</sub> deficiency was derived mostly from observations on beri-beri in man and polyneuritis in pigeons. The cardinal symptoms of vitamin-B<sub>1</sub> deficiency are degeneration of

nervous system, cardiac enlargement and dysfunction, œdema, gastro-intestinal disturbance, muscular atrophy and anorexia'.

A number of neuritic symptoms which arise in the deficiency of this vitamin have been attributed to nerve lesions, but are more probably due to functional interference owing, perhaps, to the accumulation of metabolic products, especially pyruvic acid, resulting from imperfect carbohydrate metabolism. Some of the nervous symptoms frequently encountered in patients with beri-beri are a feeling of numbness and a tingling sensation like pins and needles, usually associated with a gnawing pain in the arm, especially at night. Nervousness, loss of memory and a feeling of despondency are frequently observed.

Deficiency of vitamin B<sub>1</sub> causes disturbances of the gastro-intestinal system which include anorexia and is accompanied by hypochlorhydria and lack of tone of the muscles of the gut.

Anorexia or loss of appetite is one of the first observable and the most outstanding symptoms of vitamin B<sub>1</sub> deficiency. Many of the symptoms which were formerly believed to arise directly from the lack of this vitamin are in fact attributable to the wastage consequent on the partial starvation due to loss of appetite. It is assumed that interference with the intermediary metabolism of carbohydrate, due to deficiency of vitamin B<sub>1</sub>, is the essential factor for the loss of appetite.

Cardiac enlargement is the characteristic of human beri-beri. Aalsmeer and Wenckebach (1929) have shown that the common cause of death in beri-beri is the failure of the right side of the heart and have ascribed it to the œdema of the heart muscle. The nature of the affection may be water retention with consequent swelling rather than a true hypertrophy. Newcomb (1930) was unable to note any significant increase in water content of the cardiac muscles from cases of human beri-beri and pigeon polyneuritis as required by the hypothesis that the large heart in beri-beri is due to water retention.

Birch and Mapson (1936) studied the action of adenine nucleotide on the heart of normal and vitamin-B<sub>1</sub>-deficient animals. They succeeded in increasing further the bradycardia already present, due to deficiency of this vitamin, by injection of small amount of adenosine or adenylic acid from the muscles or yeast. Vitamin-B<sub>1</sub>-deficient animals appear to be more sensitive to the action of these compounds and at the same time unable to render them innocuous at the same rate as the normal. These authors believe that the observed bradycardia is due to failure in the deaminase mechanism, resulting in an increased accumulation of adenylic acids in the tissue. It is known that by the process of deamination, adenylic acid is converted into ammonia and inosinic acid which have little or no effect on cardiac muscles.

There are a number of other indefinite symptoms which arise in deficiency of this vitamin. Human beri-beri is frequently accompanied by œdema. It is probable that dietary deficiencies other than those of vitamin B<sub>1</sub> are related to this condition.

Retarded growth often accompanied by vomiting, decreased appetite, constipation with other gastro-intestinal disturbances, restlessness, pallor, a whimpering whining cry, unhealthy and scanty hair, represent the true picture of a marasmic child and may frequently arise and be due to a deficiency of vitamin B<sub>1</sub>.

Clinical manifestations of typical and characteristic deficiency of vitamin B<sub>1</sub> are very rare. A number of causes other than deficiency of vitamin B<sub>1</sub> operate at the same time and contribute to the clinical picture ordinarily seen in vitamin-B<sub>1</sub> deficiency. We have, therefore, no accurate means of detecting borderline degrees of deficiency of this vitamin by clinical examination. By proper chemical and clinical findings it has now become possible to study with more precision the biochemical significance of separate factors. There are now good reasons to believe that vitamin B<sub>1</sub> stands in reasonably clear-cut definition in regard to the part it plays in the animal organism.

*Cause of vitamin B<sub>1</sub> deficiency.*—The deficiency of vitamin B<sub>1</sub> may be due to diminished intake of the chief natural sources of this vitamin, such as milk, potatoes, bread, egg (yolk only), peas, liver and nuts, or it may be that the vitamin present in those foods is lost in the process of cooking. The vitamin is extremely soluble in water, and consequently a considerable proportion of this vitamin is lost if the water in which these foods are cooked is discarded. Besides, the vitamin cannot withstand heating to a high temperature.

In attempting to settle the question of the intake of vitamin B<sub>1</sub>, particular attention must be paid to the intake of those foodstuffs which though low in vitamin B<sub>1</sub> are taken in relatively large amounts. The most important foodstuffs in this connection are cereals and their refined products. In using the refined products, it must, however, be remembered that mechanical separation of the starchy part of the cereals from germ and bran coats leads to almost complete loss of vitamin B<sub>1</sub>. Polished rice, white wheat flour, white bread, and pearl barley consequently contain only traces of vitamin B<sub>1</sub>.

Even when the amount of vitamin B<sub>1</sub> in the diet is adequate, deficiency of vitamin B<sub>1</sub> may arise as a result of diminished absorption and utilization from the alimentary tract. Any form of chronic diarrhœa, such as ulcerative colitis or dysentery, that interferes with normal absorption of vitamin B<sub>1</sub> may be associated with signs of deficiency.

*Increased demand.*—Vitamin B<sub>1</sub> is not stored to any large extent in the body so that the body requirement of this vitamin must always be dependent upon a regular intake. The minimum

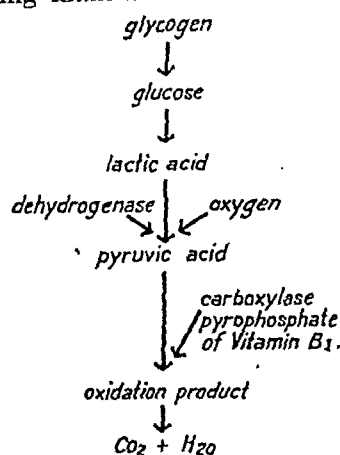
amount of vitamin B<sub>1</sub> required by the body is determined by the basal metabolic rate (BMR). Anything that raises the BMR will also increase the requirement of the body for vitamin B<sub>1</sub>. Increased metabolism as a cause of vitamin B<sub>1</sub> deficiency is of considerable practical importance. Prolonged pregnancy, lactation and rapid growth, may each participate in clinical manifestation of deficiency if the diet contain vitamin B<sub>1</sub> just adequate for the minimum ordinary requirement.

The dangerously low intake of vitamin B<sub>1</sub> prevalent amongst the population of this country, together with the changing views regarding the serious possibility of deficiency of this vitamin, raises some interesting questions, the solution of which is of great practical importance to the general health and welfare of the public.

**Physiological rôle of vitamin B<sub>1</sub>.**—Vitamin B<sub>1</sub> appears to be a catalyst for carbohydrate metabolism. Emphasis has been laid from time to time in clinical and laboratory work on the importance of carbohydrate intake and metabolism in the ætiology of beri-beri. Lewinson (1937) noted that vitamin-B<sub>1</sub> deficiency causes a derangement of carbohydrate metabolism which precedes the nervous disturbance and is manifested as hyperglycæmia. This derangement of carbohydrate metabolism has been attributed on the one hand to reduction in the amount of oxidizing enzymes, and on the other to inanition. The important contribution of Peters (1936) at Oxford has helped greatly to resolve in a highly satisfactory manner a somewhat conflicting state of affairs and has revealed for the first time the site and character of the biochemical lesions in experimental polyneuritis. The first important observation of a definite increase in lactic acid in the brains of polyneuritic pigeons and the subsequent discovery that the brain tissue of such pigeons exhibits a lowered oxygen consumption suggested that the symptoms in the pigeons might be associated with a failure of the oxidative mechanism of the brain. The addition of vitamin B<sub>1</sub> *in vitro* to such tissues restores the oxygen consumption of the brain of affected birds to normal levels, while at the same time the 'accumulation' of lactic acid disappears. This led to the hypothesis that vitamin B<sub>1</sub> plays an active rôle in tissue oxidation and is quantitatively related to the metabolism of lactic acid. Subsequently, with the discovery by Peters and Sinclair of a colour reaction of pyruvic acid, it was demonstrated that pyruvic acid accumulates in the brain of vitamin B<sub>1</sub> deficient pigeons. Peters more recently discarded the lactic oxidase theory and concluded that 'vitamin B<sub>1</sub> is related specifically to pyruvic acid oxidase in its aerobic reaction'. In the absence of vitamin B<sub>1</sub>, therefore, a block in glucose metabolism occurs at the pyruvic acid stage.

The fundamentally important discovery made by Lohmann and Schuster (1937) that in the form of a compound with pyrophosphoric acid

vitamin B<sub>1</sub> acts as a co-enzyme of the system that breaks down pyruvic acid in the living tissue, strengthens the view that vitamin B<sub>1</sub> is indispensable in the metabolism of carbohydrate. This can be shown schematically in the following manner :—



The efficiency of the pyruvate-metabolizing mechanism is lowered in the absence of vitamin B<sub>1</sub> with the result that the amount of pyruvate in the blood tends to rise. An estimation of the amount of pyruvic acid in blood and also the determinations of bisulphite-binding substances of the blood, cerebro-

spinal fluid and urine, such as pyruvic acid and methyl glyoxal, as suggested by Platt and Lu (1936), may be useful as a criterion in the diagnosis of vitamin B<sub>1</sub> deficiency.

The thiochrome reaction, which permits measurement of the fluorescence of partially oxidized thiamin, first observed by Peters and studied further by Jansen (1936), is now being most extensively employed for the estimation of vitamin B<sub>1</sub> in body fluids. The extent of the body's 'reserve' of vitamin B<sub>1</sub> is determined by estimation of vitamin B<sub>1</sub> in the urine. The urinary output has been found to be dependent upon the past intake, being low in beri-beri and in conditioned deficiencies associated with alcoholism, pregnancy, gastro-intestinal obstruction or faulty absorption. It seems probable that in the immediate future we shall be able, by means of these tests, to learn the limit of vitamin-B<sub>1</sub> concentration compatible with health. As suggested by Orr (1940) these tests may also give us an indication of the extent to which pathological symptoms noted on clinical examination may be attributed to deficiency of vitamin B<sub>1</sub>.

**Relationship between vitamin B<sub>1</sub> and thyroid.**—It has been definitely established that vitamin B<sub>1</sub> plays a direct part at least in one phase of carbohydrate metabolism. It is not surprising, therefore, to find a close relationship between vitamin B<sub>1</sub> and thyroid because of the marked effect of the gland on carbohydrate metabolism. Bernheim (1940) cited a number of references of experiments on animals to show clearly that vitamin B<sub>1</sub> counteracts the toxic action of thyroxin, prevents weight loss and loss of liver glycogen in thyroid-fed rats and is helpful in the pre-operative treatment of Graves' disease.

**Interaction of vitamin B<sub>1</sub> with acetylcholine.**—Acetylcholine is produced at most synapses and myo-neural junctions, and it is quite natural, therefore, that a disturbance in acetylcholine metabolism will be reflected in the tissues supplied by the cholinergic nerves. As suggested by

Bernheim there exists the possibility that, because of physical conditions, or local concentration effects, vitamin B<sub>1</sub> *in vivo* does control the activity of the enzyme cholinesterase which specifically hydrolyses acetylcholine. The interaction between vitamin B<sub>1</sub> and acetylcholine can offer a possible explanation for the cardiac and gastrointestinal symptoms of vitamin B<sub>1</sub> deficiency, symptoms which can be relieved temporarily by choline esters. Also part of the protective effect of vitamin B<sub>1</sub> in hyperthyroidism may be, according to Bernheim (1940), due to its inhibiting action on the serum cholinesterase, which has been observed by Antopol *et al.* (1937) to be higher than normal in patients with this disease.

*The therapeutic uses of vitamin B<sub>1</sub>.*—The synthesis of vitamin B<sub>1</sub> in 1936 has accelerated clinical investigation and made possible the application of the synthetic product in the treatment and cure of diseases which are believed to arise from deficiency of vitamin B<sub>1</sub>. Because of its anti-neuritic properties, vitamin B<sub>1</sub> has been suggested for the treatment of a host of conditions varying from systemic diseases to diseases of the nerve tissues *per se*. The synthetic product has been used with considerable success in the treatment of beri-beri and of acute neuropathy associated with pregnancy, pellagra, and chronic alcohol addiction.

Beri-beri in its severe form affects the peripheral nervous and cardiovascular systems. Spies and others (1940) suggest that 'the administration of vitamin B<sub>1</sub> hydrochloride to persons with acute beri-beri relieves the cardiovascular disturbances, induces improvement in response of muscles innervated by affected peripheral and cranial nerves, restores the normal electrical conductivity of peripheral nerves, relieves gastro-intestinal dysfunction resulting from vitamin-B<sub>1</sub> deficiency, increases carbohydrate tolerance and decreases the bisulphite-binding substances in the blood. In milder cases where typical clinical symptoms do not appear, vitamin B<sub>1</sub> improves appetite and strength as well as the feeling of general well-being of the patients. It is believed that vitamin B<sub>1</sub> is most useful in clearing up efficiently the early disorders caused by the deficiency of vitamin B<sub>1</sub> and without which the conditions would probably remain chronic.

The polyneuritis of pregnancy is probably a dietary deficiency disorder and has its origin in associated factors among which are anorexia and vomiting of pregnancy. The rational therapy should aim at provision of deficient nutrients, more especially vitamin-B complex.

Lewy *et al.* (1940) confirmed the premise that the incidence of neuropathy which is common among pellagrins is caused by the deficiency of vitamin B<sub>1</sub>. Intravenous administration of 50 mg. or more of phosphorylated vitamin B<sub>1</sub> (co-carboxylase) was followed by quantitative improvement in the electrical irritability of a number of muscles of seven out of nine of these pellagrins. Improvement was also noted in the

pupillary and corneal reflexes and in the sensitivity to touch and pin-prick. The clinical effect of co-carboxylase was found to be identical with that of vitamin B<sub>1</sub>.

Vitamin B<sub>1</sub> is specific in alcoholic neuritis. There seems to be a variable threshold at which alcoholic neuritis may arise. This may be dependent upon the state of the gastro-intestinal tract and the degree to which the absorption of vitamin B<sub>1</sub> is prevented by gastritis which is associated with low alcohol consumption. An early diagnosis of alcoholic neuritis is important and should always be looked for in the absence of high alcohol intake. Polyneuritis of chronic alcoholism is usually traceable to shortage of vitamin B<sub>1</sub> consequent on reduced food intake. Alcohol has a high calorific value. The direct relationship between the calorie intake and the vitamin B<sub>1</sub> requirement constitute the basis for the explanation of the efficacy of vitamin B<sub>1</sub> in the prevention and cure of alcoholic neuritis.

Vitamin B<sub>1</sub> has been tried in a wide variety of cases of inflammatory and degenerative diseases of the central nervous system. There are references to herpes zoster being tried with vitamin B<sub>1</sub> hydrochloride. Herpes zoster is an inflammatory disease, but its many similarities to conditions which are said to respond favourably to treatment with vitamin B<sub>1</sub> led Rattner and Roll (1939) to try vitamin B<sub>1</sub> for the pain of herpes zoster. Investigation on 16 cases showed that the treatment gave indifferent results.

Vitamin B<sub>1</sub> has also been used to relieve rest pain of ischaemic origin. Vitamin B<sub>1</sub> is now considered essential for tissue metabolism. Attempts have, therefore, been made by Naide (1939) to decrease pain by supplying tissues deficient in blood with vitamin B<sub>1</sub>, the absence of which cause disturbance of nerve function resulting in pain. The principle is based on the assumption that injection of large quantities of vitamin B<sub>1</sub> into the blood stream may raise the blood concentration of vitamin B<sub>1</sub> to such a level that even reduced blood supply in ischaemic areas would maintain an adequate vitamin-B<sub>1</sub> content of such disease.

The application of the results of investigations to the cure of deficiency diseases has yielded such striking results that 'therapeutic dietetics has become an important branch of medicine'. Specific therapy in the form of synthetic products induces more rapid remission of symptoms and assures more certain recovery. Vitamin B<sub>1</sub> may be administered either orally or parenterally, but according to Spies *et al.* (1940), the latter method is to be preferred because of the greater ease of giving large doses and the rapid improvement which follows. Although there is indication of the therapeutic use of synthetic vitamin B<sub>1</sub> in a large number of cases, yet indiscriminate use is not consistent with the interest of patients.

(Concluded on opposite page)



## Medical News

### GOVERNMENT OF INDIA'S ARP PROPOSALS

THE composition of certain air raid precautions, services and instructions for the disposition, establishment and equipment of ARP control and report centres, depots and wardens' posts are laid down in a letter which has just been sent by the Government of India to all provincial governments and the Chief Commissioners of Delhi and Baluchistan.

The Government of India have laid down scales of establishment differing in accordance with the geographical position and importance of the town.

The 'nerve centre' of the ARP system is the control centre, which in every large town will be attached to one of the report centres. The combined control and report centre is the headquarters of the ARP controller, to which all reports of damage and requests for assistance come through the agency of the warden service and of the heads of each of the ARP services—the messenger, warden, rescue, ambulance and first-aid services.

Here is a brief description of the organization of these services:—

The control and report centre comprises control, message and rest rooms, an air raid shelter, sleeping and messing accommodation. In the control and message rooms are located direct-line telephones to military headquarters, the headquarters of the district or the provincial government, fire brigade and police; and exchange lines, where possible, to warden posts.

The number of report centres to be set up in a town is governed by the number of wardens' posts. One report centre, even under severe raiding conditions, can cope with the traffic of 50 warden posts, provided the wardens are trained to send only essential messages. The number of personnel required to 'man' a report centre varies with the number of wardens' posts under its control. Thus, a report centre in a town in which

there are 50 wardens' posts would need a staff of 24, while a smaller warden service would need only 12.

The staff of a report centre comprises an officer in charge, intelligence and plotting officers, chart writer, tallyboard clerk, message clerk, clerks to assist the controller and heads of the ARP services, record clerk, message superintendent and messengers and telephonists. In towns in which the personnel of these report centres are to be paid, there will be two 'shifts' and Government have decided that a reserve of personnel of 100 per cent is to be trained.

#### MESSENGER SERVICE

The next link in the chain is the outdoor messenger service, which provides alternative means of communication, should the telephone service break down, between the report centre and the wardens' posts, first-aid posts and ARP depots.

It is hoped that the boy scouts organization will give every assistance in providing messengers. Four messengers will be needed for each control and report centre, one for each first-aid post, one or two for each warden's post, two for each ARP depot, ambulance and other service. In addition a reserve of 50 per cent is to be enrolled and trained.

#### AIR RAID WARDENS

The unit of organization in the warden service is the wardens' post. There will generally be four wardens for every 500 of population.

The wardens' post is where wardens allotted to the sector served by the post assemble when a warning is sounded, and from where they send their messages to the report centre. The post consists of a message room capable of affording protection against blast, splinters or the fall of debris, a store for equipment, a small shelter and, in certain towns, sleeping accommodation for wardens.

In densely populated areas, these posts will be spaced at 10 to the square mile, and in more 'open' areas the number will be smaller. A post will serve a group of sectors each of which should contain approximately 500 population.

The chief of the wardens' service and his deputy will be volunteers. Under them will be head wardens, each in charge of groups of posts covering 6,000 to 10,000 population. Each post will be in charge of a post warden with a deputy to assist him. In the larger towns, it may be found more convenient to organize groups of posts into divisions, each under a divisional warden.

#### A TYPICAL ORGANIZATION

The warden service in a town of 250,000 inhabitants would thus be:

A chief warden, having under him three divisions each of 80,000 inhabitants, under divisional wardens. Each division would be divided into 10 groups of 8,000, each under a head warden. The groups would again be divided into five posts of roughly 2,000 population, each under a post warden. The total number of wardens for a town of this size would thus be approximately 2,400. A reserve of 50 per cent having been laid down, the chief warden of a town of the size of Poona, for example, will have to enrol and train not less than 3,600 men for the warden service alone.

In towns in which the warden service is large enough to be organized either in groups or divisions, the chief warden will have an assistant to take charge of the routine administration and training of the service.

Special wardens will be appointed for large blocks of flats or tenements in which there are more than 100 residents. Warden services organized by industrial, commercial or public utility companies will work in close co-operation with the main service.

#### FIRST-AID POSTS

First-aid posts will deal only with 'light' cases, i.e., persons who are, usually, able to walk. Serious casualties will be sent direct to hospital, after preliminary attention from the first-aid party, and should not pass through these posts.

(Continued from previous page)

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Normally, first-aid posts will be established less than two miles apart, so that an injured person will not have to walk more than a mile for attention. Each post will be in charge of a doctor, who will have under him at least one fully-trained nurse, first-aid workers and stretcher bearers. A large post, serving an area in which there are from 30,000 to 60,000 inhabitants, would have a staff of 30, and a small post, for 3,000 to 20,000 population, half that number of staff.

#### THE CASUALTY ORGANIZATION

The first-aid posts are only one section of the casualty organization, other sections being the ambulance service and first-aid parties.

Ambulances will be provided, as a general rule, on the scale of one ambulance to every two first-aid parties and a car to carry 'sitting' cases to every three parties. Each ambulance will have a driver and attendant and each car a driver. In addition, a reserve of 100 per cent is to be enrolled and trained. Government have under consideration methods of converting private cars into ambulances.

#### FIRST-AID PARTIES

For every 100,000 inhabitants of a typical town, there will be approximately 20 first-aid parties to give immediate attention to casualties. A first-aid party will consist of a leader and four men, one of whom will be the driver, who will also be fully trained in first aid and will work with the party, and will be equipped with a car. It is hoped to provide officers of the St. John Ambulance Association as heads of the first-aid party service who would also act as staff officers to the head of the casualty organization.

#### RESCUE SERVICE

When a warden reports a bombing incident to his report centre, he will set in motion machinery which will at once order the necessary ARP services to hurry from an ARP depot to the scene of the bombing, to extricate casualties, render first aid or deal with fires.

For example, in a demolished building a rescue party would be sent. Rescue parties will be divided into heavy and light. They will be equipped with lorries carrying lifting tackle, ropes, ladders, axes, stirrup pump, first-aid boxes and all equipment needed to extricate wounded from wrecked houses, render first aid and tackle fires. Heavy rescue parties will carry, in addition, a portable acetylene-gas cutting outfit and heavier lifting tackle.

Light rescue parties will comprise 11 men—a leader, three skilled and six unskilled men and a lorry driver. As many lorries as possible will be provided with detachable light trailers. Heavy parties will consist of nine men, but their equipment is designed to deal with buildings of heavy construction. In all parties there will be men capable of turning off gas, water and electricity supplies.

The service, as a whole, will be in charge of a technically qualified officer. In large towns, the head of the service will have one or more staff officers, qualified constructional engineers, responsible for organization, administration and training. Each group of six parties will be in charge of a technically qualified group leader. The approximate strength of rescue parties is to be 10 for every 100,000 of population. The proportion of light to heavy parties will vary with the type of buildings in the area.

#### THE ARP DEPOT

In order to prevent delay in sending services to a bombed area, first-aid parties, ambulances and rescue parties will be based on combined ARP depots, which will be so spaced that the rescuers can get to a bombed area within 10 minutes of receipt of the message from the control and report centre ordering them out.

The number of personnel located at one depot may be as many as 200 to 250 but will often be less. There will be a depot superintendent, who will have a deputy and a staff comprising telephonists, messing staff, sweepers, a clerk and a storeman.

#### SIR PRAFULLA CHANDRA RAY

THE Indian Chemical Manufacturers' Association presented an Address to Acharya Sir Prafulla Chandra Ray, Ex-President of the Association, on the occasion of his attaining his 81st Birthday, at the premises of the Association at 102-A, Clive Street. Mr. N. R. Sarkar, Member-Designate of the Viceroy's Executive Council, presided over the function.

In the course of the Address, which was read by Dr. H. Ghosh, Vice-President of the Association, the manifold services rendered by Acharya Ray to the public and specially in the field of Science and Scientific Research were eulogised and his unique service in establishing the Chemical and Pharmaceutical Industry in India was referred to. It was stated that the scientific achievements of Acharya Ray found their fulfilment in industrial enterprise and as a pioneer in modern scientific research; he was also a pioneer in the application of that research to industrial development. At a time when the country was industrially backward and scientific research in India was comparatively unknown, Acharya Ray gave a practical demonstration of what Indian talents could do by founding the Bengal Chemical and Pharmaceutical Works which had served as a forerunner of several chemical and pharmaceutical works. The address then referred to the organization of the chemical and pharmaceutical industry by Acharya Ray as the Founder-President of the Indian Chemical Manufacturers' Association, which had made signal progress in the short period of three years of its existence and whose membership now included almost all the important chemical and pharmaceutical works in the four corners of India. The members of the Association, it was stated, therefore considered it not only their privilege but also their duty to offer humble tributes of respect and love to Acharya Ray on this occasion.

In his reply, Acharya Ray expressed satisfaction at the gradually increasing strength of the Association which had become a representative organization. He stated that in order to facilitate the growth of chemical and pharmaceutical industries, the country required in the first place, a liberal state policy, to render all assistance to such enterprises, and in the second, sincere support from the public. He referred to the inferiority complex among a large section of the people, whenever the question of choosing between foreign and home-made chemicals and medicines was concerned and appealed to the manufacturers to remove this impression by propaganda, demonstration, and by raising the standards of Indian products, wherever necessary. He said that he had not been content to remain a mere theoretical man in the laboratory, but had tried to devote the best portion of his life in giving chemical research a commercial and industrial turn and although the success had not been phenomenal a beginning was made and it was now for the business men and industrialists to carry it to the final success. He thanked the Chemical and Pharmaceutical Manufacturers for the kind words in which he had been felicitated.

#### GROWING POPULARITY OF 'AGMARK' GHEE

WITH the growing popularity of 'agmark' ghee, still greater attention is being paid by the Agricultural Marketing Staff to control quality and by strict supervision to defeat the activities of unscrupulous dealers who fraudulently use imitations of the 'agmark' seal on ungraded ghee.

During the first six months of this year, 36,554 maunds of ghee, worth more than Rs. 26,22,550, were graded at the various grading stations throughout India.

The checking staff collected large numbers of samples of graded ghee from different distributors for analysis at the Central Control Laboratory. In almost every case the samples were found to conform to the original grade designation.

The checking staff, however, detected a few cases in which retailers were selling ungraded ghee in tins sealed with bungs coloured to resemble the bungs used for genuine 'agmark' ghee. These dealers were dealt with under the provisions of the Agricultural Produce (Grading and Marking) Act of 1937.

## Public Health Section

## MATERNITY AND CHILD WELFARE

## NURSERY SCHOOL AND PARENT EDUCATION IN SOVIET RUSSIA\*: A REVIEW

IN 1929, a party of educationalists drawn from almost all countries interested in kindergarten and nursery school education was invited to visit Soviet Russia. In the party was Miss Patty Smith Hill, Professor of Education, Columbia University, New York. So much was Dr. Hill struck by the developments of the work in health protection and education of the pre-school group that she persuaded the writer of this book 'Nursery School and Parent Education in Soviet Russia', Vera Fediaevsky, to set down, in a form which would make it available to all interested in the development of the pre-school child, the principles and practices by which the Soviet Union planned and provided services for the protection of motherhood and infancy.

Now that the orientation of the war has brought Soviet Russia into the sphere of immediate interest, it is perhaps not out of place to offer a somewhat extended summary of certain portions of this very interesting book that will appeal not only to workers in maternity and child welfare but also to organizers of community health programmes.

In 1914, the infantile mortality rate in Russia was 270 per thousand live births and in the same year in Moscow one-third of all deaths were of infants under one year. Almost immediately after the October revolution a special department for the protection of motherhood and infancy was inaugurated as part of the Commissariat of Health and its first object was to determine the special causes of this very high mortality rate prevailing in Russia.

By a process which is not detailed, the special causes of this great loss of infant life were found to be, (i) lack of medical care—this was not only insufficient in the urban areas, but in most villages completely lacking, (ii) the heavy handicaps under which women worked during and after pregnancy, as well as the poor facilities and lack of care during confinement, (iii) the general illiteracy of the population reflected in ignorance regarding the need for medical care and education of infants and children, and (iv) the lack of both medical care and supervision especially in villages during the harvest months when large numbers of mothers were labouring in the fields.

The author states that so distressing were the conditions in the country that many women

were delivered 'under a hay stack or among the sheaves of grain', while in most cases no medical aid was available. The *babka* of Russia was as ignorant and ubiquitous as the most ignorant form of Indian *dai*. No regularity or modern practice was observed in the daily family routines of feeding and sanitation, and great numbers of children were carried off each year by summer diarrhoea and dysentery. As the mother had to return to work very soon after delivery, the care of the infant often devolved upon a small brother or sister, with the result that many neglected infants were devoured by wild animals.

The author states boldly that as a result of the measures taken to meet these problems the infantile mortality by 1932 had been reduced by 40 per cent. Apart from the training of staff, the Commissariat of Health set out to establish a far-reaching system of organized crèches, and consultation centres, supplemented by courses in child health and child education and, further, to inaugurate an elaborate system of propaganda, aimed at breaking down conservatism and ignorance. The scheme also included provision for research into the problems of child health, child education and maternal care. Threaded through the entire system was of course instruction in the ideology of the regime, but it is the actual developments in legislation and organization which make the book a valuable contribution to present-day literature on child health and education.

Three chief lines of approach were charted out by the Department for the Protection of Motherhood and Infancy. These were: (i) legislation, (ii) organization and work in national institutions, and (iii) propaganda.

*Legislation.*—One of the most important developments was the removal of illegitimacy. The Code of Laws on Marriage and Family, section 25, reads: 'Children whose parents are not married have the same right as the children whose parents are legally married'. Further sections of the same Code are designed to secure *alimony* 'for the welfare of the child' for the unmarried mother who may, during her pregnancy, or after the child is born, name the father. The court is instructed to place implicit trust in the mother's testimony, and should the father deny his fatherhood, he must disprove it. The law is planned and administered in the light of the child's 'greatest good'. This cannot be more simply and significantly stated than it is in the words of section 33 of the Code 'parental rights are put into effect in the interests of the child, exclusively'. This precludes all possibility of the utilization of the child for gain at any period during its minority.

Under the labour laws also, great privileges are granted to the pregnant and nursing mother

\*Nursery School and Parent Education in Soviet Russia. By Vera Fediaevsky and Patty Smith Hill. 1936. Kegan Paul, Trench, Trubner and Company, Limited, London. Pp. 265. Price, 10s. 6d.

with the object of securing or increasing her economic independence, and to facilitate the rearing of her child. Discharge of a woman during pregnancy or while on motherhood leave is forbidden: she must be reinstated in her post after her leave, and no night work or overtime is permitted. In the case of factory workers only, there exists a unique provision for maternity. Under this system 'leave by degree' a woman is entitled to leave with full salary for a period of sixteen weeks, eight weeks before and eight weeks after delivery. If the woman or her husband is insured, in addition a sum of money will be granted for the care of the infant and also 25 per cent of the wages of the woman will be paid monthly for nine months from the time of the birth of the child. To all women workers are extended the privileges of the use of consultation centres, milk kitchens, medical advice, etc. In the case of the poor mother, money will also be provided for the layette.

Once a mother returns to work she is entitled to half an hour's rest for every  $3\frac{1}{2}$  hours' work during the nursing period, and if she is employed in a factory the child is placed in the factory crèche under the care of doctors and nurses. If the child falls ill, leave is granted to the mother on full wages.

Naturally, such a system costs an enormous amount of money and there are various sources from which funds are obtained. The most important of these is a state social insurance which applies to hired workers only. These, however, include workers employed by the state, or by communities or private individuals. This tax is paid exclusively by business and industry. Fifteen to twenty per cent of the profits are utilized for this purpose, and the insurance provides not only free medical aid to all workers, but pensions for aged workmen and support during unemployment for the worker and his family. It pays also for the assistance during pregnancy, confinement and for nursing care, and for the 'leave by degree'. The budget for provision for mothers and children in 1934 was the equivalent of 120 million rupees. The rural worker (for example a worker on a collective farm) is on the same footing legally, but is not a hired worker and therefore cannot be benefited by the funds of the state social insurance. Assistance in this case can be provided from the collective farms funds only. Usually one month before and one month after delivery on half wages is the maternity leave available for the rural worker.

It is an interesting development of this programme of mother and child protection that all public conveyances give preference to expectant mothers, and mothers with infants in arms.

**Consultation centres.**—The development of 'consultation centres' for women and children is a feature of the programme of the Department of Protection of Motherhood and Infancy.

These centres have both curative and preventive functions related to (a) pregnancy, confinement and gynaecological disease, and (b) infant care. They also participate in the work of health centres by planning measures to protect the health of the woman worker.

The consultation centre for women may be separate, but is usually connected to a centre for children. Medical pre-natal care, health advice, and instruction are given; the diagnosis and treatment of gynaecological disease are undertaken also. In addition to these activities (which are not different from those of many maternity centres in various parts of the world), there is a section for advice in regard to birth control and one where permission may be granted for legal abortion if it is considered dangerous to the health of the woman, or when *economic circumstances make abortion advisable*. In cases where therapeutic abortion is advised *induction of abortion may be undertaken in the centre*. It is not to be assumed from this that abortion is encouraged; on the other hand, instruction on the dangers of abortion is given at all such centres.

The consultation centre for children is intended to provide health advice, medical care and guidance. Immediately a child is born it must be registered and the local consultation centre is informed of the birth. The child must be brought to the centre within two weeks of birth and from that time onwards regularly, as advised by the doctor in charge. In the event of the infant not attending the centre the visiting nurse calls to advise the mother to bring it up for consultation. Each centre has a physician in charge and although health protection is the chief purpose of the centre, medical care is also carried out. Vaccination is compulsory, and in most large cities anti-diphtheritic and anti-measles inoculations are undertaken on a large scale; in some places the von Pirquet test is also done. A milk kitchen is attached to each consultation centre, and, where artificial feeding or supplementary feeding is necessary, the doctor's prescription for the feeding is taken by the mother to the trained dietitian in charge of the milk kitchen who provides the necessary feeds. Payment is made by the parent to whatever extent is possible. Spare human milk is stored also in these milk kitchens for the use of needy infants. The author states that it is the aim of the Soviet Government to establish ultimately, nutrition stations to provide all food for all children both in the home and in institutions. 'Educational consultations' (child guidance clinics) are held in some centres only, but, even when these are not provided, there is a mother and child corner for self-education of the mother regarding the needs of the child both physical and mental, and the types of toys which should be provided for his play. In the newer centres specialist advice is also available. Free legal advice is given also in most of these centres, and where difficulty

arises the woman may be helped to obtain alimony for the support of the child.

Home visits are carried out by visiting nurses attached to the centre and every effort is made to help the mother to adopt her environment to the needs of the infant. Such centres really become general clinics for young children, with 'follow-up' in the home. A close connection is maintained with tuberculosis and venereal disease dispensaries and with crèches and maternity hospitals. Information on vital statistics is provided in all factory centres.

The enormous size of these consultation centres can be judged from the fact that to no. 2 centre in Moscow 61,000 visits were paid in 1934 and 200 to 250 children were seen daily. Each doctor attached to the consultation centre is responsible for a portion of the district, usually housing 400 to 500 children. His duties include visiting severely ill children in the homes and all infectious cases among children, as well as imparting health advice, and controlling all health activities in his area. He (or she) is responsible for the administration of protective inoculations in times of epidemic. The doctor is also called upon to select rooms which are to be used as nursing rooms in factories, to inspect these rooms from time to time and advise on urgent needs.

All the trained staff do teaching work, also short courses are given in child welfare and domestic hygiene.

For children who show evidence of rickets or anæmia, or have been exposed to infection by tuberculosis, there is a type of open-air playground provided to serve a group of centres; to these play-grounds children may be referred only by the doctors in charge of the consultation centres. These are 'the sanitary nursery play-grounds' where the children are in the open air under all conditions of weather for six to eight hours a day. The play-ground is equipped with all simple forms of recreation, including, in some instances, a bathing pool. The children are provided with meals and are under trained supervision.

*Crèches.*—Apart from the orthodox type of crèche, that is, a room or series of rooms with open-air facilities, where children are cared for and kept under supervision, this book describes types of primitive crèches; some are both original and interesting especially those in whose development the co-operation of mothers and even school children is utilized.

The ordinary type of crèche is met with in both rural and urban areas, and in the Soviet Union the crèche is expected to fulfil two objects: to liberate the woman for other duties, *social and political*, and to provide an educational background for the child and parent. Many of these crèches are financed jointly by the state, from local budgets, from state social insurance, by operatives, agricultural enterprises and industry. The parents, as a rule, contribute according to their means. No plans for a

factory will be passed unless they include suitable crèche arrangements.

Each such crèche is managed by a council to which both teachers and parents elect representatives. Members of the workers' committee and women's organization are also elected. *All the members of such a council receive courses of instruction in health education and in crèche organization and management, motherhood and child care.* The working hours of the crèche correspond with the shifts in the factory. These crèches may work 24 hours a day in 1 or in 2 or 3 shifts, or as a 'long-day crèche', that is, open for ten to fourteen hours. An infant may be admitted to a 24-hours' crèche for several reasons, for example, when the mother is ill, is continuously on night duty, or is found to be ailing and requires rest.

Sixty to 100 children ranging in age from six months to three years are accommodated in most of the bigger crèches. These are simply well-conducted modern crèches, under medical supervision. All children are medically inspected on arrival and facilities are provided for bathing, feeding, sleep and recreation. The nursery teacher is responsible to some extent for parental education and for making home contacts with the parents.

In the rural areas the needs of the workers on collective farms have resulted in different types of crèche service being organized. In the main, two types of crèche have been developed. The 'permanent' crèche and the 'summer' crèche. Difficulties of locality, poverty of equipment and less extensive financial support have modified the facilities provided, but the methods are the same and the crèche is expected to provide whatever the ingenuity, common sense and training of the organizers can effect. The permanent crèche is in charge of a trained nurse and is responsible not only for the supervision of the short-term crèches or summer crèches in her district, but also for conducting short courses for workers with a view to producing a supply of semi-trained nursery staff.

The problem of providing facilities for the nursing mother harvesting in the field often far from her home has been met by the introduction of travelling crèches. 'These are trucks, trains or caravans on wheels which follow the workers wherever they go'. Collective farms are encouraged to provide fruit and vegetables for sale to the workers. Primitive milk kitchens are set up and all children of workers on collective farms are provided throughout the year with wholesome food.

In urban areas certain unusual types of crèches have been established. One of the most interesting is the 'boulevard nursery groups'. These, like the railway station crèches, were established in 1932. Their object is to provide children with fresh air, exercise and play under the supervision of a trained nurse on the boulevards of the city. Boulevard groups are, as all health

activities for children, connected with the consultation centres in their area. The children go home for meals, but are otherwise in the open air from 8 a.m. to 6 p.m. The parents are expected to contribute according to their economic status. Another unusual form of crèche is a 'walk'. This is also an open-air activity planned in close consultation with the centre doctors. In essence, it is simply arrangement for supervised play in the open air with provision of a shelter for midday rest and meals managed each day by the mother of one of the children. A 'walk' is organized for the families in one house and the mothers take it in turn to spend the day with the children, supervising their play and rest under a trained nurse. The educational value of such an organization is obvious. Parents contribute towards the cost of the meals and the trained nurse is provided by the government. Older school children are also encouraged to participate in the supervision of these 'walks'. No play apparatus is available in most cases.

The railway station crèche is intended especially for the relief and rest of mothers with young children undertaking a long journey through the country. These railway crèches have a 'filter' room through which the children must pass in order that sick children can be segregated.

After the medical inspection they pass on into the room which corresponds to their age group. There are rooms for children under 3, from 3 to 7 and over 7. Cheap meals and sterilized milk are made available. There are provisions for rest, play and instruction. The mother may wash soiled clothing, bathe her baby and herself and enjoy a period of relaxation. At the railway buffet wholesome food for children is always available at cheap rates. In addition to these facilities special coaches are attached to the long-distance trains for the exclusive use of mothers with children.

Another interesting type of institution which has been evolved is the 'home for mother and child'. This corresponds to the convalescent home in other countries, and in the U. S. S. R. it represents a comfortable home where the working mother, after the birth of the child, may pass the eight weeks' leave which has been granted to her. Here she is taught infant care, she receives adequate rest, instruction in mothercraft, in the problems of social hygiene and 'legal problems of family welfare'. For orphan and unwanted children there is a *boarding-out* system similar to that which has gained prestige in the United States. Parents who accept such children are selected with great care and are known as 'patronat parents'—such homes are under constant supervision.

**Research.**—Research into mother and child care in the U. S. S. R. has fallen into two distinct categories, that which is conducted in institutions (and there are 20 in all of these institutions for the protection of motherhood

and infancy), and that which is related to the study of local problems in different parts of the country.

A country of the size of Russia with so diverse a population maintaining such varying standards of education and culture has naturally been compelled to consider how the far-flung units of the Republic can be brought into alignment, so that the benefits of maternal and child protection may be available throughout the Union. Expeditions therefore were planned to study the problems of workers in the Siberian coal fields and mines where coloured metals are extracted, and of those of the tribes in Central Asia; expeditions went to factories, to automobile works, etc., and studies were made in collective farms among rural communities.

**Institute research.**—Each institute is associated with six to twelve centres and crèches, which form its field of study and experimentation. The object of all research is 'to formulate principles by which practice can be standardized, while the excursions for the study of local problems are intended to find means to put these principles into practice under varying local conditions'. The organization and efficiency of crèches are 'intensively studied'. *The efficiency of a crèche is judged by the efficiency of the mother as a worker and as a social and political unit.* Comparative studies are made from this point of view, of mothers who are not utilizing crèche care and of mothers who are utilizing crèche care of a less official type.

With the study of children the problems of diagnosis and therapy the clinic of paedology in Moscow is concerned. Here also the development of normal and abnormal children is being studied both by records for 24 hours at a time and by the photocine method. Nursery institutions for handicapped children are also subjected to research. Norms of development and behaviour are being worked out. In the words of the author, 'one of the most important branches of research is the study of the diet and equipment for the nursery or crèche'.

When the book was written most research had been devoted to the infant and child under 3 years of age, but schemes of research on older groups were being planned. The work that has been done is on such a large scale and so comprehensive that it is almost impossible to put down the complete trends in short form even with the aid of so attractive a book as this. One of the most advanced and attractive of them is the planning and adaptation to local circumstances of the child's environment and play apparatus, with which it is impossible to deal here.

Parts of the stage upon which these welfare movements are set have counterparts all over the world in all conditions and in many countries, and a study of the results achieved and the methods of approach cannot be without value.



# NUTRITION

## PUBLIC HEALTH ASPECTS OF ENRICHED FLOUR AND BREAD

*A report of an address*

By W. H. SEBRELL, M.D.

*The Nutrition Advisory Committee, Washington*

As a physician and a health officer I am vitally interested in the health of the people of this country. The enriched flour and bread programme is one of major importance in accomplishing something constructive to meet the serious dietary deficiencies which exist in this country to-day. Many of you may think that the American public is well-fed. As a matter of fact all of the recent dietary studies made in this country indicate very clearly that a large part of our people are getting diets which are below the standards necessary to maintain health. It has been reliably estimated that not less than one-third of our entire population are getting diets which are not entirely adequate.

Another misconception which some of you may have is that the inadequate diets in this country are found entirely in the lowest income groups. While it is true that most of the inadequate diets are found in this group, it has been found that inadequate diets also extend into the highest income group. Many of you in this audience are probably eating inadequate diets, not from inadequate incomes, but from poor food selection, special diets or lack of knowledge as to what you should eat. I have seen actual deficiency diseases in well-to-do business and professional people simply because they had neglected their diets as most of us are inclined to do. They eat what they want to eat and not what they need.

American diets are most likely to be deficient in some of the vitamins and minerals in spite of the large increase in the consumption of fruits, vegetables and milk in this country in recent years. For many years many different agencies in this country have been attempting through educational means to improve the American diet. It may surprise some of you to learn that the American diet is more deficient in thiamine, which is one of the vitamins of the B complex, than was the American diet of 100 years ago. Some of you may have felt that the increased consumption of fruits, vegetables and milk has been one of the causes of the decreased consumption of flour and bread. I do not believe that this is true. One of the major causes for the decreased consumption of flour and bread in this country may be one which you have not considered very seriously or may have thought did not amount to very much, that is the fact that dietitians, home economists, colleges of home economics, and all the institutions in this country that are teaching nutrition have taught, and under present conditions must continue to teach, that white flour is practically devoid of minerals and vitamins, and that in obtaining an adequate diet one must be sure to get the necessary vitamins and minerals first from other sources and then complete the diet with any foods that suit the appetite—including white flour and white bread.

### *Diet and the physician*

Physicians have to do just that in making special therapeutic diets. When I have to make a special diet I must first assure the vitamin and mineral intake; having secured that I can then consider the protein, fat and carbohydrates and then I can say eat enough white bread to make up your calories if you care to do so. This sort of thing has been going on for years.

In addition, whenever you hear anyone talking about reducing diets, which are so popular with the ladies these days, you almost invariably hear them advise a decreased consumption in flour and bread. This situation has been brought about by the highly refined milling processes which have made white flour such a beautiful product to look at but which have so seriously

injured its nutritive value compared with the original wheat from which it is made. I do not blame the millers for making a highly refined flour. As I see it you men in industry are trying to give the public what it wants. The fault has been that the public did not want the right thing and I think we have to educate the public to want a flour and bread of high nutritive value.

The tendency of the American public to use highly refined foods has been manifested in other ways than in flour. I wonder if you realize that if you add together the calories consumed in the average diet from white flour, refined sugar, and highly refined fats you find that these items make up more than half an individual's average daily calorie consumption. As a result he must get all of his minerals and vitamins from the remaining 1,000 calories or so which make up his diet and this is the reason that our diets to-day are more deficient in thiamine than they were in the past. The increased vitamins and minerals supplied by fruits and vegetables are not enough to make up for the loss which has occurred in eating more highly refined foods of other types. It is factors such as these, which taken together with poor food selection and low incomes are the major causes of the widespread dietary deficiencies existing in this country to-day, and I cannot over-emphasize the importance of these things from the point of view of preventive medicine.

A new concept has arisen in preventive medicine in the past few years. You no doubt think of preventive medicine as vaccination against smallpox, immunization against diphtheria, and sanitation of water and sewage. To-day preventive medicine has advanced beyond that view. The up-to-date health officer is now concerned with building the healthiest possible population with the greatest resistance to disease. A major part of such a programme is that the population shall receive a diet adequate in all respects. For this reason the widespread prevalence of deficient diets is of serious concern to the health officer and these dietary deficiencies and means for their prevention are now being studied in considerable detail.

### *B-vitamin and iron deficiencies*

It is recognized that the most prevalent deficiencies in this country to-day are those due to deficiencies in members of the vitamin B complex and in iron. I have no intention of giving you a dissertation on the diseases produced by these deficiencies but there are a few facts with which any well informed person should be familiar. The three members of the B complex which are most important from a health point of view in this country are thiamine, riboflavin and nicotinic acid.

Thiamine deficiency in its extreme form causes a disease known as beri-beri. This was formerly thought to be a tropical disease which did not occur in the United States. We now know that this is not the case. We see many cases of severe beri-beri and we recognize that a condition known as peripheral neuritis which occurs in cases of pregnancy and in alcoholics, as well as in other diseases, is also a manifestation of thiamine deficiency which was not recognized a few years ago. But from the point of view of the entire population, even more important than these serious deficiencies has been the very recent recognition that thiamine deficiency also causes symptoms such as mental depression, easy fatigue, and undue anxieties and although the individuals with these symptoms are not sick in the sense that they do not go to bed, these things result in a lowered efficiency and possibly other more serious economic consequences. There is every reason to believe that these symptoms are widely prevalent in this country because of our reduced thiamine intake.

The symptoms of riboflavin deficiency were just recognized about two years ago. This condition is manifested by fissures in the corners of the mouth, a scaly condition around the nose and ears and disturbance in vision caused by blood vessels growing into the cornea of the eye which obscures the vision and may lead to blindness. These symptoms miraculously disappear on the addition of riboflavin to the diet. Although this



disease has been recognized only so recently it is evident now that it also is widespread in this country.

The importance of riboflavin is further evidenced by the fact that it is found in every living cell, at least in all the higher forms of life, and when experimental animals are deprived of it they invariably die as is also the case with most of the other vitamins.

Nicotinic acid deficiency leads to a disease known as pellagra which was formerly thought to be confined largely to the southern United States. We now know that it exists throughout the United States. The symptoms of pellagra have been known and recognized for a long time and I do not believe it would be an exaggeration to say that not less than 200,000 cases occurred in this country last year. The disease kills more than 3,000 people in this country each year. Yet it can be entirely prevented by nicotinic acid which is one of the members of the vitamin B complex.

It has been known for only a few years that nicotinic acid will prevent pellagra. When I use the words 'nicotinic acid' I know most of you immediately think of nicotine. It is most unfortunate that the name of the deadly poison nicotine sounds so similar to the name of this life-saving vitamin 'nicotinic acid' which is found so widely in our daily foods. This unfortunate similarity is due to the fact that although nicotinic acid was made in the laboratory in 1867 no one found any practical use for the substance until to everyone's astonishment it was discovered in 1937 that it would prevent and cure pellagra, a disease for which we had previously had no specific treatment. It may interest you to know that during all the years when I was searching for the pellagra-preventive vitamin I had a bottle of this same nicotinic acid sitting on the laboratory shelf—never suspecting that what I was seeking was standing at my elbow.

More important than the above symptoms, however, from the point of view of numbers of people involved, is that there were many thousands who had red tongues and suffered from indigestion and weakness due to a partial deficiency in this substance. In addition, there is an acute mental condition characterized by confusion and disorientation which is due to nicotinic acid deficiency.

Another point of considerable interest about these various diseases is that they are rarely found alone. We usually see an individual with symptoms of two or all three deficiencies at the same time. This is not surprising since these three factors of the vitamin B complex are usually found in the same foods. An individual does not select a diet that is deficient in just one of these things. Since his deficient diet is due to the absence of natural foods containing these vitamins the diet is likely to be deficient in the entire B complex rather than in just one of the factors, and in order to prevent the development of these deficiencies it is necessary to supply all of these factors as they would be supplied by natural foods.

One of the most important of the mineral elements for the human body is iron. Iron is necessary for the formation of the hæmoglobin of the blood and if there is an insufficient amount of iron in the diet an anæmia develops. Individuals living on foods raised on soils which are deficient in iron develop anæmias, and school children have been found in this country with about one-half of the amount of hæmoglobin in their blood that they should have simply because their food did not contain enough iron. These sickly, weak, undernourished, and frail children can never be any better until this iron deficiency is corrected. Identical conditions develop whenever the diet is deficient in iron for any cause, whether it be because the foods are raised on iron deficient soils or because the iron has been removed from the food by milling or other processing.

#### *Food vs. pills*

There are other deficiency diseases in the United States in addition to the above, however, from a public health point of view they do not cause the deaths, the illnesses and the economic loss which are caused by the above.

Therefore, we are directing our attention to devising a programme which will solve once and for all the problem of continuously getting into the American diet enough thiamine, enough riboflavin, enough nicotinic acid and enough iron, to prevent the development of these deficiencies. I feel that the proper way to approach this problem is through dietary means and not through the use of vitamin pills or tablets. These conditions have developed as a result of our improper handling of foods and should be corrected by changing the handling of our foods so that the vitamin and mineral content is restored to a level which will be effective for this purpose.

There is no intention to make bread or flour a medicine. We are not attempting to treat disease—that is in the province of the physician. We are attempting to prevent disease and to prevent the disease conditions which we have brought down on our own heads through improper food practices and which should be, and can be corrected, by making suitable changes in our food habits. Just a few years ago I took the point of view that the way to correct these conditions was to try to stimulate the increased consumption of foods naturally high in these vitamins. I still think that this point of view is correct theoretically. Although I recognize that such a programme if it succeeds at all will progress so slowly that it cannot meet the extensive deficiency conditions in our population to-day; therefore, as I see it the next best thing is to add these vitamins and minerals to foods which are consumed in large quantities especially by the low income groups.

We already have one example of this in the various forms of vitamin D milk that are now widely used in this country. Some of these products were introduced about ten years ago in an effort to solve our rickets problem, and to-day it is recognized that they are of the utmost value in the prevention of rickets. They have added very little to the cost of milk and yet are one of our best and most economical means of preventing rickets.

#### *A stronger staff of life*

Bread has always been the mainstay and principal component of the poor man's diet. The fact that it has become nutritionally inferior has taken away these vitamins and minerals from the very population groups which need them most. I feel that the addition of thiamine, riboflavin, nicotinic acid, and iron to flour and bread in sufficient quantities will represent a major contribution towards solving our dietary deficiency problem. There is great public interest in this subject at the present time. This public interest should be utilized and guided on a national scale in the right direction so that the public will obtain a product which will be of real health significance.

It is of equal importance that the public shall not be misinformed or misled. They should be reassured that they are receiving a food and not a medicine. The industry must take on itself the preparation and regulation of products for which you yourselves will permit no unsubstantiated claims. It is equally important that these enriched flours and breads shall reach the public at the lowest possible price. From a public health point of view it is most important to reach the lowest economic groups, and a premium price product is likely to be beyond their reach.

Again from a health point of view, it is of little importance how the necessary levels of vitamins and minerals are obtained in the flour and bread. The important thing is that the necessary substances are there in the final product in a quantity sufficient to be of value. And I would like to see this accomplished in the most economical way possible. I hope we will see these levels obtained in a variety of ways to meet a variety of tastes so that it will have the widest possible utilization. There is no reason why we should not have white flour to which the synthetic materials have been added, a lightly milled, creamy coloured flour, and a dark flour with the vitamins and minerals retained by the milling process, and also that we shall

have a variety of breads of various colours and flavours just so the vitamins and minerals are there. As far as I am concerned, I just want to know that the individual who is on a deficient diet gets into his stomach these things in the quantities in which he needs them and it is up to you gentlemen to get them to him in the best possible way.

Various nutritional programmes have been tried in the past in an effort to solve our dietary deficiency problems. We have seen years of effort spent in an attempt to get people to eat whole wheat bread. I think we all recognize that this programme has been definitely a failure. It has not solved the problem. Too many people still demand white flour and white bread, and I think we should give it to them as long as they demand it but also give them an opportunity to have their vitamins and minerals concealed in this product if they must have it that way.

As I have indicated, our deficiency problem is one of multiple deficiencies, therefore, the addition of thiamine alone is not sufficient. We have seen in recent months a number of breads appear on the American market which have been fortified with thiamine and these breads have been advertised as being a superior product on this account. This is not enough. We frequently see cases of thiamine deficiency which go on and develop symptoms of nicotinic acid deficiency or riboflavin deficiency. The addition of thiamine is only a partial answer to the problem; just as the addition of nicotinic acid or of thiamine and nicotinic acid would constitute only a partial solution to the problem. We need to put back into the flour vitamins which were originally present in the wheat, not just some of them, or you will still leave us with thousands of sick people. I want to remind you again that as a physician interested in public health I am also interested in solving this problem and that means the addition of all of the substances I have mentioned to-day. If we can make such an enriched flour and bread available we should be able to change our teaching practices and our educational activities in regard to the use of this flour and bread instead of having to relegate these items to the groups of foods which fail to supply many vitamins and minerals. Nutritionists and dietitians will be able to recommend them and utilize them in preparing adequate diets and I think the leaders in nutrition education in this country would welcome such an opportunity to utilize such an important element in our diet instead of having to tell a poor family that they must buy more expensive foods in order to get their necessary vitamins and minerals. It is much simpler to tell that family to shift to enriched flour and bread. I hope to see this enriched flour and bread promoted in a conservative educational manner on the basis of its value as a contribution to a health-preserving diet, and as a permanent programme sold to the population on the basis of this value and with no promotional flash in the pan hysteria. If this is to be of any value it must be a permanent change in the American dietary and should be approached from that point of view. It is imperative that we have co-operative action between all of the agencies concerned. If an educational campaign is undertaken by health or other authorities before the flour and bread are ready commercially it will be just so much wasted effort. If the various baking and milling companies undertake industrial campaigns without co-operation and without proper advice in regard to their advertising, exaggerated and unwarranted claims may nullify much of the work of the programme.

I feel that here is a real opportunity for a great American food industry to carry on a programme which will result in a permanent and valuable contribution to the health of this nation, and at the same time benefit our agriculture by increasing the proper utilization of one of our most valuable and economical foodstuffs.

Eagerly we look forward to the day when our children and our children's children will be armed with the armour of robust health.

## SANITARY ENGINEERING

### BORED-HOLE ABSORPTION PITS

By RAJ SAHIB KASHI PRASAD, M.B., B.S., D.P.H.  
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**Definition.**—A bored-hole absorption pit is a hole 20 feet in depth and 16 inches in diameter, bored with a machine known as a boring outfit. A limited amount of sullage water is absorbed and disposed of by it every day.

**History.**—Bored holes, which were originally introduced as latrines\*, have been utilized as absorption pits also. These have had an extensive trial for several years past in the Health Unit, Partabgarh, and some other places in the province.

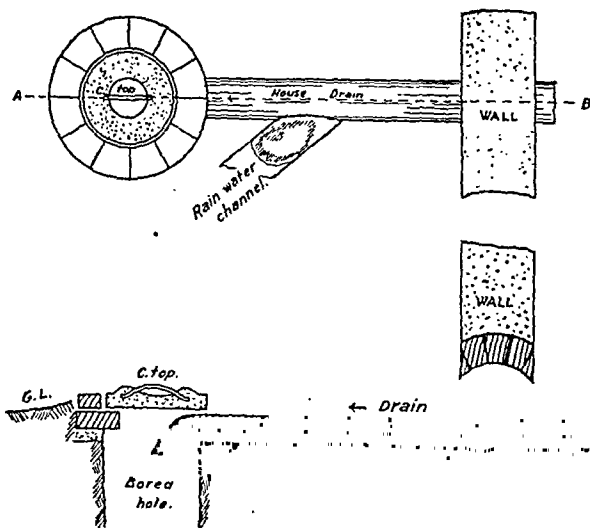
**Advantages.**—Bored-hole absorption pits require very little space, are easy to construct and cost less than other devices for disposal of waste water. They are well suited for village homes for a variety of reasons. The house drains usually open towards the front of the dwellings. The ground over the bored-hole absorption pits could be covered over during the life of the pits and the ground is not only left clean and dry, but is also made available for use, like the other parts of the open space in front of the houses.

Bananas or other plants, usually recommended in this connection, are soon eaten away or destroyed by cattle, unless they be carefully protected all the time. Even if they grow, they engender dampness and dirt; mosquitoes are also attracted owing to the moisture and vegetation.

Bored-hole absorption pits do not require the services of a sweeper or even attention from the householder.

Brick soakage pits mean more cost, more space, less efficiency, and their annual renewal is not a pleasant job for the orthodox villager.

**Uses.**—Bored-hole absorption pits are made to dispose of waste water from houses, bath



\* The method of preparation of bored-hole latrines was described in some detail in the *Indian Medical Gazette* of April 1934 and of July 1935.—Editor, I. M. G.

enclosures, and wells. They can be used to dispose of urine (from a urinal), effluent from a septic tank, washings from a slaughter house or a cattle-shed, and waste or filthy water from any other source, provided the amount of such water is limited.

**Limitations.**—Bored-hole absorption pits can, of course, be made only where a boring outfit is available, and where the soil is not rocky or does not contain much of 'kanker' or bricks. It is inadvisable to have pits within four feet of a wall, as there is a danger of its collapse during rains. They should not be very close to drinking-water wells. There should be at least five feet square of open space on which the boring machine could work. One pit can absorb easily only 10 to 15 gallons of water per day.

**Life of a pit.**—If rain water is not allowed to get in, a pit will last several years. As silt and solid matter also find their way into the pits, they gradually fill up.

After one or more years there may be some caving in of pits receiving a lot of clean water. In such cases it will be advisable to throw in brick-bats to obviate collapse of the walls. The pits will, however, continue to serve their purpose after such treatment.

Construction of a silt chamber in the course of the drain, does prolong the life of the pit, but it is not desirable, since it means unclean work and only helps to retain in the drain filthy matter, which should not be there.

**Construction of a pit.**—Four labourers will be able to bore one hole in a day, two holes if the soil is soft or sandy. The villagers can do this themselves, if an outfit and a 'mistri' who knows how to work the borer are supplied to them. They could themselves make a drain of bamboos or country tiles.

A mason will be able to construct a proper drain and top for the pit. These will be more efficient and lasting.

The drain should preferably be of the saucer type. Unnecessary bends and angularities should be avoided. The gradient should be sufficient. For the storm water, a rain-water channel should branch off from the drain. During rains it is desirable to shut off the portion of the drain leading to the pit and to open out the rain-water channel instead.

To guard against erosion of the walls of the pit it is necessary to prevent the water in the drain from running down the walls of the pit. This can be easily arranged by having a spout or a properly-cut brick, which will project into the pit from the terminal end of the drain.

The mouth of the pit should be covered to prevent children or small animals from falling in. This may be done by thorny shrubs, by inverting a basket or clay basin over it, or by covering it with a wooden plank or stone slab. The best arrangement is to have a movable cement slab resting on a masonry ring, 9 inches wide (thick) and 6 inches deep, constructed all

(Concluded at foot of next column)

## MICROBIOLOGY

### THE INCIDENCE OF BACTERIUM AEROGENES IN THE FÆCES OF PERSONS SUFFERING FROM INTES-TINAL INFECTIONS AND ITS SIGNI-FICANCE IN WATER ANALYSIS

By K. V. KRISHNAN, M.B., B.S., M.R.C.P. (Edin.),  
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and

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WITHIN the last few years several articles have appeared regarding the significance of the *aerogenes* group of coliform organisms in the bacteriological analysis of water. The general trend of most of these papers has been that a much greater sanitary significance than was accorded in the past will have to be attached to the presence of these organisms in water. This change in the view point has been chiefly necessitated by the results obtained through

(Continued from previous column)

round the top of the pit. This top may be a few inches higher than the surrounding ground so that rain water may not get in.

**Costs.**—In Partabgarh district a hole 20 feet in depth and provided with a masonry top and drain costs about Rs. 3, made up as follows:—

	Rs.	As.	P.
Wages of four labourers for a day ..	1	0	0
Wages of a mason for a day ..	0	8	0
Wages of a coolie to assist the mason ..	0	4	0
Cost of bricks, cement, etc. ..	1	4	0
<b>TOTAL ..</b>	<b>3</b>	<b>0</b>	<b>0</b>

**General.**—A boring outfit costing Rs. 135 (pre-war price) is available from Messrs. Ivan Jones Limited, 8, Dalhousie Square, Calcutta. It comprises of—

'Samson' earth borer 16 inches diameter fitted with adjustable shaft to enable boring to a depth of 20 feet,

Handle for rotating borer,  
Double ended jumper,  
2 shackle bolts  $\frac{3}{4}$  inch,  
5 feet chain sling,  
60 feet  $\frac{3}{4}$  inch diameter Manila rope,

and can be utilized for boring small wells as also pits for plants.

An outfit, suitable for use in soft soils, can be had from the Agricultural Institute, Naini, Allahabad, for Rs. 40 (pre-war price). This is lighter and can be used by fewer labourers.

A trained 'mistri' is available in Partabgarh. He is willing to go to any district, if he is paid actual railway expenses (3rd class) for the return journey and wages at As. 12 a day for the period he is detained.

studies on the types of coliform organisms present in human faeces.

It has been found that *Bacterium aerogenes* is not uncommon in human faeces. Mollari, Randall and Reedy (1939) isolated *Bact. aerogenes* from 40 per cent of human adult faeces. Horwood and Webster (1937) from their studies of the stools of certain patients opined that the normal bacterial flora of the small intestine possibly consists essentially of *Bact. aerogenes*. Parr (1937) found that 25.2 per cent of organisms isolated from human faeces belonged to the *aerogenes* type, Sen (1938) found 9 per cent and Raghavachari and Iyer (1940) 8 per cent. Furthermore, it has been shown that a very large percentage of the coliform organisms isolated from pathological material such as urine, are of the *aerogenes* type (Burke-Gaffney, 1932). Although these observations have led American bacteriologists to believe that the presence of *Bact. aerogenes* in water is almost of the same significance as the presence of *Bact. coli* their viewpoint has not been accepted everywhere. The Ministry of Health (1940), London, while admitting that *Bact. aerogenes* may frequently be found in human faeces states that as a rule their number compared with *Bact. coli* is very small and therefore their presence is not of the same order of importance as the presence of *Bact. coli*.

In the studies on the incidence of *Bact. aerogenes* in human faeces, noted above, the samples used had all been obtained from healthy individuals. Hitherto, as far as we are aware, no one has studied the incidence of *Bact. aerogenes* in the faeces of diseased persons and especially in the faeces of those suffering from specific intestinal infections. Such studies appeared to us to be of far greater importance in assessing the true significance of *Bact. aerogenes* as indicator of faecal pollution than the studies on stools of healthy persons. The present study was therefore commenced with the object of determining (1) whether *Bact. aerogenes* is present in the stools of persons suffering from intestinal infections such as cholera, dysentery, typhoid and diarrhoea; (2) if so, what is the relative proportion of *Bact. coli* to *Bact. aerogenes* in these stools; and (3) whether the number of *Bact. aerogenes* present warrants the acceptance of the American view that the presence of *Bact. aerogenes* in water supplies is also to be looked upon with suspicion.

Samples of stools were collected from persons suffering from intestinal disorders admitted into the Carmichael Hospital for Tropical Diseases, the Medical College Hospital and Campbell Hospital, Calcutta. These were inoculated into large MacConkey's plates (directly in case of liquid stools and after making an emulsion with sterile normal saline in the case of solid stools) and incubated for 24 hours at 37°C. On an average, twenty coliform colonies were picked out from an area fairly representative of the entire plate. These were classified on the basis

of M.R., V.P., citrate and indole tests. The Eijkman test was done on a large number of the strains in the commencement of this study, but, as it gave very discordant results (as obtained by other workers in this country), it was decided not to use it for the purpose of the present classification. Tables I, II and III give the results obtained.

#### Results:

TABLE I  
Number of stools showing *Bact. aerogenes*

Type of stools	Number of stools examined	Number of stools showing <i>Bact. aerogenes</i>	Percentage of stools showing <i>Bact. aerogenes</i>
Normal	10	3	30.0
Intestinal disorders of unknown aetiology.	34	12	35.3
Bacterial dysentery	15	7	46.7
Cholera	11	10	90.9
Typhoid	8	7	87.5
TOTAL	78	39	50.0

It will be seen from table I that the percentage of faeces showing *Bact. aerogenes* is very high in the intestinal group and that it varies from 35.3 per cent to 90.9 per cent with an average for the whole group of 53 per cent. In the

TABLE II  
Ratio of *Bact. aerogenes* colonies to total colonies

Type of stools	Total number of coliform colonies examined	Number of <i>Bact. aerogenes</i> obtained	PERCENTAGE OF <i>Bact. aerogenes</i>	
			Average	Maximum
Normal	180	5	2.77	15
Intestinal disorders of unknown aetiology.	580	66	11.14	70
Bacterial dysentery	232	46	19.85	95
Cholera	200	74	37.00	100
Typhoid	114	23	20.19	35
TOTAL	1,306	214	16.4	..

cholera and typhoid stools the percentage was highest, being about 90 per cent. Another fact worth mentioning here is that almost all the samples of stools taken from cholera patients showed the presence of *Bact. aerogenes* in varying proportions, while those taken from persons

TABLE III  
Coliform colonies in stools classified according to type.

	Number of stools examined	Total number of coliform colonies examined	<i>Bact. coli</i>		<i>Bact. aerogenes</i>		INTERMEDIATES		IRREGULARS		
			Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Other types
Normal .. ..	10	180	172	..	5	..	3	..	..	..	..
Intestinal disorders of unknown aetiology.	34	580	484	27	60	6	1	2	..	..	..
Bacterial dysentery ..	15	232	168	13	46	..	..	..	..	..	5
Cholera .. ..	11	200	104	2	70	4	..	..	..	..	20
Typhoid .. ..	8	114	81	..	19	4	4	1	..	..	5
TOTAL ..	78	1,306	1,009	42	200	14	8	3	..	..	30

with cholera-like symptoms (which on examination proved to be non-cholera) showed either an absence of *Bact. aerogenes* or the presence of a small number.

From table II it will be seen that the ratio of *Bact. aerogenes* colonies to total colonies in the intestinal cases is not at all small or negligible. It varied from 11.14 per cent to 37 per cent with an average for the whole intestinal group of 18.6 per cent. This again is higher than the ratio in healthy stools. A perusal of the last column in this table will show that the percentage given for each sub-group is only an average and that in certain individual instances the percentage went up to 95 per cent and 100 per cent. This is a very important finding and is of special significance in the interpretation of results obtained during water analysis.

From table III it will be seen that the types of coliforms present in faeces could be arranged in the descending order of frequency thus: (1) *Bact. coli* type I, (2) *Bact. aerogenes* type I, (3) *Bact. coli* type II, (4) Irregulars type III, (5) *Bact. aerogenes* type II, (6) Intermediates types I and II, (7) Irregulars types I and II. This shows that *Bact. aerogenes* is second in importance among the coliforms present in faeces of persons suffering from intestinal infections.

#### Discussion

The significance of the above findings from the point of view of water analysis is indeed great. It will be accepted that pollution of water with faeces of persons suffering from intestinal infections is definitely dangerous. It has been shown that the stools of some of these persons contain *Bact. aerogenes* in very large numbers. Therefore the presence of *Bact.*

*aerogenes* in water supplies even in small numbers can on no account be completely ignored in all cases. In this country some water bacteriologists are of the opinion that *Bact. aerogenes* can be ignored unless present in very large numbers, but the results presented above do not justify or support such an opinion. As the coliforms in a cholera stool may at times consist mainly of *Bact. aerogenes* and as contamination of water with such a stool will only show *Bact. aerogenes*, the presence of the latter must be looked upon with suspicion also. The contention of many in the tropics is that if *Bact. aerogenes* is taken as an indication of faecal pollution then it would exclude many waters which are now being consumed with impunity for indefinitely long periods. Although the observation may be true there is no denying the fact that in passing such waters for human consumption there has always been an element of risk involved. Looked at from the bacteriological point of view, a safe water for human consumption is one which is free from pathogenic organisms. That being so the rational procedure for finding out whether a water is safe for human consumption or not would be to determine the presence or absence in it of specific pathogenic bacteria, such as *Bact. typhosum*, *V. cholerae* or *Bact. dysenteriae*. This task being elaborate and time-consuming is not ordinarily undertaken in routine work; even if it is attempted, the chances of detecting the pathogenic organisms are uncertain. It has therefore become necessary to resort to some simpler indirect method for detecting faecal pollution of water, so that one may reasonably predict the presence or absence of pathogenic organisms in it. Since the pathogenic organisms conveyed by water are primarily of intestinal

origin, the presence of bacteria normally inhabiting the intestinal canal, such as the coliform organisms which are more easy to demonstrate, is taken as evidence of faecal pollution of water. *Bact. coli* being the commonest and most predominating type of coliform organism present in ordinary human stool, its presence in water is taken as an indication of faecal pollution. But now that it has been shown that *Bact. aerogenes* is also frequently found in stools and that it may in some cases be the most predominant organism, the necessity has arisen to revise our ideas regarding the significance of *Bact. aerogenes*. But before doing that it should not be forgotten that *Bact. aerogenes* is also found in other situations than the intestine of man and that *aerogenes* from these sources is not of the same order of importance. One of the immediate problems to be solved, therefore, is to find out some test by which we can differentiate between *Bact. aerogenes* of intestinal origin and *Bact. aerogenes* of soil and vegetable origin. Until that is done it is no doubt true that no definite opinion can be given about the true significance of *aerogenes* in water. But in view of the findings detailed above that several pathological stools may consist almost purely of *aerogenes*, it seems safe and reasonable to look upon *aerogenes* with real suspicion in water analysis. If this is not done it is indeed risky. To avoid the risk the least that can be done is to accept rigidly the Ministry of Health standard and not attempt to relax or modify it to suit the tropics. The plea that in the tropics there should be some laxity of standards does not seem justifiable or worthy of acceptance at present and in the absence of specific evidence in support of such laxity. At least with regard to filtered, chlorinated and unchlorinated pipe water supplies the evidence is increasing for the adoption of a standard in strict conformity with the English (Ministry of Health, 1940) or the American (Amer. Pub. Health Assoc., 1936) standards. Although in theory the former standard is accepted in India, in practice it is often relaxed to an extent which in our opinion is unsound.

#### Summary and Conclusion

1. The incidence of *Bact. aerogenes* in the faeces of persons suffering from intestinal infections ranged from 35.3 per cent to 90.9 per cent with an average of 53.0 per cent.
2. The ratio of *Bact. aerogenes* to total coliforms varied from 11.14 per cent to 37.0 per cent with an average of 18.6 per cent.
3. In cholera stools in some instances, 95 per cent of the coliforms present consisted of *aerogenes*.
4. The presence of *Bact. aerogenes* in water should also be looked upon with suspicion.

#### Acknowledgments

Our thanks are due to (i) Prof. M. N. De, M.R.C.P., of the Calcutta Medical College Hos-  
(Concluded at foot of next column)

## Current Topics

### Pain in the Female Genital Tract and its Treatment

By A. C. PALMER, O.B.E., F.R.C.S., F.R.C.O.G.

(From *Medical Press and Circular*, Vol. CCV, 26th March, 1941, p. 250)

WHEN pain is due to disease in the female genital tract, it may be spoken of by the patient as ovarian pain or pain in the womb, but its site will be demonstrated as being in the hypogastric region, just above the symphysis pubis, in one or both iliac regions, in the sacral region, in the perineum or possibly in the upper part of the thighs. When pain is complained of as occurring in one or several of these regions, the patient may be neurasthenic, hysterical, or the subject of a pelvic lesion. Possibly she has two or all three of these conditions. In the majority of women a bi-manual examination will enable one to recognize an abnormality in the pelvis, in the lower abdomen, or occupying both areas, but if the patient is unduly fat, or unable to relax her abdominal muscles, bi-manual examination without anaesthetic may give no additional information, and under these circumstances the examination must be repeated under anaesthesia. In the neurasthenic or the hysterical, it is probably wise to make examination under anaesthetic the rule, rather than the exception, unless the physical signs are obvious.

#### NEURASTHENIA

As seen by the gynaecologist, this condition is characterized by two main features:

- (1) Over response to stimuli, especially slight stimuli.
- (2) Diminished power of resistance to pain and depressing mental influences.

This may be the result of exceptional stress in a woman whose nervous system was of good quality before she was exposed to the stress, or more commonly it is due to the ordinary stresses of life working upon an inferior nervous equipment.

The exercise of the reproductive function is a frequent cause both of nervous exhaustion and of disease of the

(Continued from previous column)

pital, (ii) the Superintendent, Campbell Hospital, and (iii) the Director, School of Tropical Medicine, Calcutta, for permission to collect the requisite material for our study, from their cases.

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reproductive organs. This is why disease of the female generative organs and neurasthenia are frequently seen together. When child-bearing has produced both local disease and nervous exhaustion, the local disease aggravates the nervous exhaustion. Cure of the former will help the cure of the latter; but the cure of the nervous exhaustion requires general treatment as well as that directed to the local condition. When the nervous exhaustion is cured, the neurasthenic patient will be well and cease to complain, at least for the time being or until she is overpowered by the next stress. If the neurasthenic happens to be a hypochondriac as well, that is to say, a woman who believes without cause that she is the subject of serious bodily disease, she will not be cured.

Neurasthenia is met with in both sexes at all ages, but is rare in very young girls and old women, and I think it is no longer open to dispute that the liability of this disease is inherited with the nervous system. It is common during the reproductive period of life, and its chief cause is the strain involved in reproduction: the strain of pregnancy, the stress of labour, the exhausting effort of lactation, and the anxiety inseparable from the care of children; the disturbed sleep; the impairment of nutrition sometimes associated with pregnancy and lactation; and perhaps the anxiety of some local disease—anxiety which is out of proportion to the importance of the local condition. Most cases of neurasthenia associated with uterine disease in married women are due primarily to exhaustion of nervous energy by child-bearing and its consequences, and the uterine disease aggravates the condition.

Exertion produces fatigue, which in health is quickly repaired by rest and food.

Exertion pushed far into fatigue causes exhaustion and recovery will take longer; possibly it may not be complete. Work without rest or variety may exhaust and, in adolescent girls, overpressure at school or in preparation for examination sometimes fulfils this condition. A precocious girl may be encouraged by parents and teachers, who mistake information and accomplishments for education, to force her brain at the neglect and expense of her body, forgetting or not knowing that the first aim of education is to produce a good animal. From such training there is likelihood of producing a woman with very sensitive nerves, an active imagination, and a feeble body who is rendered unfit for her duties by slight causes, and is apt to torture herself by the dread of future disease. *Physical pain* may produce neurasthenia by its persistence, especially when it is severe enough to prevent or interrupt sleep. Long continued unhappiness, especially of conjugal origin, may be a cause. Sudden shock is an infrequent but occasional cause, and may be associated with cessation of menstruation persisting for years after the shock. Trivial uterine conditions are often associated with the neurasthenic; a non-tender retroversion; or possibly an unusual degree of ante-flexion without dysmenorrhœa, the existence of which has become known to the patient by some unfortunate accident. These give rise to no symptoms and require no treatment, but the knowledge of their existence has added to the patient's anxiety, and it may be difficult to make her believe that they are of no consequence. Slight uterine disease, such as a small erosion; a mild degree of chronic cervicitis; or a small cervical polyp, may require treatment, and the disappearance of the symptoms will help the patient, but her neurasthenia will not be cured. This requires the removal of the cause, which may not be possible. If the cause can be removed the exhausted nervous system may never become robust, especially if part of its weakness is inherited.

Some stress has been laid on neurasthenia because patients suffering from this condition are subject to morbid sensations in the lower abdomen and pelvis as well as in other parts of the body. Sacral backache, dragging pain in the pelvic region, and abdominal discomfort or pain from flatulence may be attributed to pelvic disease, and it is important to be quite certain that the genitalia are free from disease before

attempting to convince the patient that the symptoms are due to general weakness and nervous exhaustion.

In hysteria a common feature is the presence of hysterogenic zones or hyperalgesic spots. One of these spots is situated in the ovarian region; that is about two inches internally to the anterior superior iliac spine. Pressure over this spot causes a 'sickening sensation', and not uncommonly a feeling of constriction in the throat and palpitation of the heart. In such a case it may be necessary to exclude disease of the genital organs, even though the patient is known to be suffering from hysteria, and a pelvic examination should be made under anæsthesia. Lower abdominal pain with a lump rising out of the pelvis may occur with hysterical retention of urine. Catheterization and pelvic examination should remove any doubt with regard to the condition of the genital tract.

#### THE CHANGES IN THE GENITAL TRACT WHICH GIVE RISE TO PAIN

The sites of pain have already been mentioned as being situated in: The sacral region, the iliac fossæ, the hypogastrium, the perineum, or the thighs. Sometimes the pain will be complained of as being 'Inside, low down', the patient being unable to localize it to any definite area.

The immediate local cause of pain is increased in the tension within the tissue of origin. This change may be due to:

- (1) Inflammation.
- (2) Trauma.
- (3) Muscular contraction.
- (4) Vascular changes secondary to trauma or independent of trauma.
- (5) Fatigue of weakened muscles.

The type of pain associated with neurasthenia and hysteria in the absence of a pelvic lesion has already been described.

Any one of the five conditions mentioned may give rise to pain in several or all sites described above. I think that the explanation is that the pain complained of by the patient is referred pain, that is, pain referred to the appropriate skin area. Whether the pain remains confined to this area or spreads over into adjacent skin areas depends on the stability of the patient's nervous system and her general health.

New growth has not been mentioned as a cause of pain because I think it is not a cause. Growing ovarian tumours, be they cystic or solid, and uterine fibroids do not cause pain; nor does the growing pregnant uterus cause pain. The growth is slow and unaccompanied by change in the tension within the tissues that are growing. Something in addition to growth is necessary before pain is produced: a vascular change due to some peculiarity of the growth; a twist, an invasion of other tissues, or the onset of inflammation.

The areas where pain is referred are those supplied by nerves coming from the tenth dorsal to the second lumbar and from the first to the fourth sacral segments. Hyperæsthesia may be present in pain due to any one of the causes mentioned. In pelvic inflammation it is accompanied by deep tenderness and later by a lump of varying consistency, size and shape, and usually with an indefinite outline, unlike any of the known lumps unaccompanied by inflammation. Hyperæsthesia in the hypogastric region and iliac fossæ is present when the inflammation is acute, but dwindles and may easily pass unnoticed as the inflammation becomes chronic.

A patient with prolapse may have widespread hyperæsthesia in the lower abdomen, sacral region and thighs at the end of the day, but probably not in the morning after a good night's rest.

The pain of an acute torsion may be associated with superficial tenderness for a short time after the torsion, but it will disappear in a few hours if there is no further disturbance of the peritoneum.

In the more acute forms of dysmenorrhœa, superficial tenderness is often present in the abdomen, sacrum and thighs. It may also be present in cases of congested retroverted uterus which give rise to pain.

History and physical signs will usually reduce the choice in diagnosis to one or two probable causes; sometimes the diagnosis will be certain only on laparotomy; occasionally only on histological examination, and rarely not even then.

#### PELVIC INFLAMMATION

This wide term includes pelvic peritonitis, ovaritis, salpingitis and cellulitis. In its common clinical manifestation all four are present, but peritonitis is the outstanding feature, though it is originally called salpingitis. The commonest causal antecedent of salpingitis is neglected miscarriage (77 per cent), accidental, self-induced, or criminal. Next in frequency come ascending gonorrhœa (11 per cent) and tubercle (11 per cent). Tuberculous salpingitis does not give rise to recognizable symptoms till secondary infection has occurred. An uncommon but definite cause is infection of a small ovarian blood cyst, resulting from adhesions to neighbouring gut. In the acute stage, the symptoms are lower abdominal pain, hyperæsthesia, rigidity, and deep tenderness accompanied by constitutional disturbance. The treatment is expectant unless the patient is failing to respond, when the lower abdomen should be drained; or additional lumps develop, when the lower abdomen should be opened, tissue damaged beyond recovery, removed, and the pelvis drained.

Occasionally the acute attack will quiet down and not be heard of again, but most commonly the respite is temporary only, and the apparent cure will pass into the recurrent subacute or chronic pyosalpinx. Sooner or later operation and the removal of some tissue will be required, possibly a pyosalpinx only, possibly bilateral pyosalpinges, bilateral ovarian abscesses and chronically infected uterus.

#### TRAUMA

Trauma usually means a twist, a twist of the pedicle of an ovarian cyst or solid tumour; of a pedunculated fibroid; perhaps of the uterus, the seat of a fibroid. If not a twist, perhaps the rupture of a tubal pregnancy, or short of rupture rapid stretching of the tube due to bleeding into its lumen. At the outset the symptoms are similar in each case; lower abdominal pain accompanied by a varying degree of shock. If the cyst does not rupture, an obvious tender lump will be present. It might be a solid ovarian tumour or a pedunculated fibroid, but ovarian cysts are common. Twisted solid tumours much less common, and twisted fibroids rare. If a ruptured tubal pregnancy is present, the symptoms will change to those of internal abdominal hæmorrhage. If the tube becomes distended by clot, a small one may absorb, but the more usual course is the development of a low-grade pelvic peritonitis. The condition then resembles a chronic pyosalpinx, and is diagnosed as such. Further hæmorrhages may occur, and give rise to another acute attack. In each case the treatment is laparotomy and removal of the damaged or overgrown tissue, with control of hæmorrhage in ectopic cases.

#### MUSCULAR CONTRACTION

Excluding normal labour, outstanding examples of painful uterine contraction are:

- (1) The inco-ordinate uterus in labour.
- (2) Spasmodic dysmenorrhœa.
- (3) Hæmatocolpos.
- (4) Submucous pedunculated fibroid in process of extrusion.

By the term '*Inco-ordinate uterus*' I mean that the lower uterine segment does not progressively and uniformly relax; and the upper uterine segment progressively and uniformly retract during labour. The uterus as a whole may contract, while the upper segment retracts and the lower segment fails to relax. A ring may develop in the lower segment perhaps at the level of the neck of the *fœtus*, or in the external os; or more rarely in the upper segment. Here it may be vertical or oblique, and appears to be associated with an error in fusion of the Muellerian ducts. This condition develops independently of obstruction outside the uterus, but it may be difficult to exclude the latter

when the ring prevents the head from descending in spite of strong uterine pains. If the two conditions happen to be present, the ring will probably not be recognized. Before the inco-ordinate uterus was recognized, women sometimes died from exhaustion in labour without obstruction. Some thirty years ago Mr. Gordon Luker and I watched a woman do this, and wondered why, speculating as to what we had missed. Fifteen years ago we were beginning to recognize what might be happening, and would then have tried antispasmodics, and if the patient did not respond quickly, we would have persisted and probably persisted too long. We should have been guided by traditional conservatism and by fear of criticism for breaking new ground. Now, if we thought this condition was present, we should try antispasmodics, give the patient a maximum of twenty-four hours in strong labour, and then perform Cæsarean section, believing that by failing to do so we should neglect our duty and deny our experience.

#### SPASMODIC DYSMENORRHOEA

Here the pain is probably due to inco-ordinate uterine action or spasm. In its more severe form the condition cannot be cured by medical treatment. It can sometimes be cured by simple dilatation, but more certainly by artificial labour, that is to say, by dilatation followed by packing the cervical canal with tents for forty-eight hours.

Cases of severe dysmenorrhœa are accompanied sooner or later by some degree of neurasthenia, and then the result of treatment—cure or relief—depends on how far the neurasthenia is also cured.

In hæmatocolpos the pain is due to obstruction of the menstrual flow, and the condition is cured by removing the obstruction. As a rule it is not this pain which brings the patient to hospital, but that due to retention of urine.

#### SUBMUCOUS PEDUNCULATED FIBROID IN PROCESS OF EXTRUSION

The pain in this condition is typical uterine contraction pain, felt in the sacral and hypogastric regions. The amount of pain depends on the size and consistency of the mass being extruded, but even so pain is not the prominent feature; it is usually masked by the bleeding.

#### VENOUS CONGESTION NOT DUE TO TRAUMA

A well-involved mobile retroverted uterus or a congenital retroverted uterus does not give rise to intermenstrual pain because it is not heavy and congested. A heavy sub-involuted uterus with venous congestion will give rise to sacral backache and hypogastric discomfort. I think the pain is due to the increase in vascular tension and associated œdema in the body of the uterus. It disappears when the uterus is maintained in the proper position for venous drainage.

#### MUSCULAR FATIGUE

That muscle fatigue can cause pain is no doubt common knowledge to all who have passed beyond the stage of adolescence. It may be acute while the muscles are at work, and be graded down to the discomfort of stiffness after work has ceased.

A weakened pelvic diaphragm (levator ani and superficial perineal muscles) may find the task of supporting the abdominal contents beyond its capacity and so give rise to some pain. It has already been stated that this is one of the features of neurasthenia but it is also one of the features of the overworked mother and housekeeper who is not yet neurasthenic. It is also the primary symptom of prolapse during the period when the pelvic floor is giving way, and is felt in the back, in the iliac regions, or in all the areas of pelvic pain. It is suitably described by the term 'Girdle ache' or 'Girdle pain'. When the prolapse is complete, with the vagina inside out, pain is a much less prominent feature. The reason may be that the genital canal having ceased to fall, there is now very little drag on the pelvic tissue. Furthermore, the pendulous perineal mass prevents the patient from

being active on her legs, and she is compelled to sit or rest for the greater part of the day. For the neurasthenic or tired women general treatment and a

holiday, if it can be obtained, but when prolapse has begun a pessary is necessary as a temporary measure or support, and operation for cure.

## Reviews

**GLEANINGS FROM MY RESEARCHES. VOLUME I—KALA-AZAR: ITS CHEMOTHERAPY.**—By Sir Upendranath Brahmachari, Kt., M.A., M.D., Ph.D., F.R.A.S.B., F.N.I. 1940. Published by the University of Calcutta. Pp. xx plus 461. Illustrated.

IN Bengal, the immediate response to the word 'kala-azar' put by the psycho-analyst would on nine occasions out of ten be 'urea-stibamine' or 'Brahmachari', so deep an impression has Sir Upendranath's work on kala-azar and his now world-famous drug made on the mind of the man in the street. To the medical man, and especially to those who like the reviewer have been interested in kala-azar for a number of years, the word Brahmachari means much more, for we all know him as a great chemist; and every chemist in Bengal, not to mention chemists in foreign countries who are familiar with Brahmachari's work, know him as a famous physician and research worker. His book on the subject was the first book on kala-azar in the English language, and the successive editions and his more ambitious *Treatise on Kala-azar* have taken their place amongst the world's monographs on tropical diseases.

It is therefore with very great interest that we received the first volume of Sir Upendranath's *Gleanings from My Researches*. This volume is no less than a verbatim re-publication, with occasional explanatory notes by the author himself, of all the most important papers on the treatment of kala-azar contributed by him during the last 25 years. And a very formidable array they make.

Brahmachari made a special study of chemotherapy of antimonial compounds in kala-azar infection. An extensive series of chemical and therapeutical experiments with various antimonials were carried out by him between the years 1915-1921, at the Calcutta Campbell Hospital. At first, several new inorganic antimonials were synthesized and tried. Then later, following in the footsteps of that other famous chemist, Ehrlich, he turned to the organic antimonials and invented urea stibamine.

The frontispiece serves to remind one of the early struggles of Sir Upendranath.

It is impossible not to see a parallel between the lives of two great research workers who made their crucial discoveries in Calcutta. Both modest self-effacing men whose thoughts were never for honour, recognition, or gain, but solely for suffering humanity. Both worked with the minimum of official encouragement, not to say against opposition, and both with poor equipment and under trying physical conditions. Ross in his small dark laboratory in the Presidency General Hospital with a microscope with a cracked lens and Brahmachari in an outhouse in the Campbell Hospital with no water or gas laid on, by the light of a hurricane lamp, both worked in the sweltering heat of Calcutta, and each described his triumph in memorable and poetic language, thanking his God or Providence rather than taking credit to himself.

Ross wrote

'God

Hath placed within my hand  
A wondrous thing; and God  
Be praised

\* \* \* \* \*

I know this little thing  
'A myriad men will save.'

And Brahmachari

'I well recall that memorable night—I found about ten o'clock in a little room with a smoky dimly burning lantern that the results of my experiment were up to my expectations. But I did not know that Providence had put into my hands a wondrous thing and that this little thing would save the lives of millions of my fellowmen.'

**TEXTBOOK OF GYNÆCOLOGY.**—By Wilfred Shaw, M.A., M.D. (Cantab.), F.R.C.S. (Eng.), F.R.C.O.G. Third Edition. 1941. J. and A. Churchill Limited, London. Pp. viii plus 616, with 4 plates in colour and 255 text-figures. Price, 21s.

It is only five years since the first edition of Wilfred Shaw's *Textbook of Gynæcology* was published, so that it is a tribute to the author that it has been found necessary to bring out a third edition so soon.

To see the name Wilfred Shaw on the title page of a book or paper connotes that a perusal of such book or paper will repay one.

In the third edition of this book one's great expectations are fulfilled, for it is indeed a worthy successor to the previous editions. It follows the same sequence as the previous volumes; the plates and diagrams being much the same. However, the text has been elaborated and new matter has been added: the most notable addition being a chapter on chemotherapy and endocrinology, and the author has added valuable matter to the chapter on radiotherapy.

Mr. Shaw advocates douching the uterus after evacuation of the products of conception. This is an excellent recommendation which however has fallen into desuetude of late years. He also advocates the use of the Aveling repositr for treating cases of chronic inversion of the uterus, and states that the 'ingenious abdominal operations' devised for cases of this condition are hardly ever necessary as the repositr is usually successful, and the only operation justified is vaginal hysterectomy in certain cases. These opinions coming from such a savant as Wilfred Shaw must command attention; they are not however universally accepted.

The book is an excellent one and amongst the best in the literature.

H. E. M.

**MEDICAL ORGANIZATION AND SURGICAL PRACTICE IN AIR RAIDS.**—By P. H. Mitchiner, C.B.E., T.D., D.L., M.D., M.S., F.R.C.S., and E. M. Cowell, C.B., C.B.E., D.S.O., T.D., D.L., M.D., B.S., F.R.C.S. Second Edition. 1941. J. and A. Churchill Limited, London. Pp. lx plus 296, with 58 illustrations including 1 coloured plate. Price, 12s. 6d.

THE authors of this book had the foresight to see the likelihood of a demand for a book of this kind; they have, we hope, had their material reward, for we notice that the first edition was reprinted twice. The first edition was pre-war but post-Munich, appearing in March 1939; this second edition is post-'blitz'. Much of what was written in the first edition was theoretical, or comparative, being based on experience in Spain. That experience was very valuable, but probably those who have seen service in both Madrid and London during air raids will have found many practical differences in their two experiences.

One should perhaps not be too critical, in view of the conditions under which this book was rewritten, for one must assume that the experience of two such surgeons as the authors was not wasted during the

autumn 'blitz' in England last year, but there is evidence of patching where rewriting was indicated. For example, the sections dealing with blood transfusion are very patchy. On p. 93 is written 'The technique of simple blood transfusion is well known and will not be described here'; it may be simple but many are unfamiliar with it and will look to this book for help. If they persist, ignoring the statement quoted above, they won't be altogether disappointed, because apparently in 1940 blood transfusion became less simple, and, if details are not given in this book, at least one is told where they are available; for the Medical Research Council apparently did not think that the procedure was so simple and gave these details in their *War Memorandum No. 1*. The authors occupy the space in which just a few of these details might have been reproduced by irrelevant, even if true, statements, such as that a blood transfusion costs £15 in Russia, and by a tall story from their Spanish friend Durán Jordá who claims to have given 7 pints of blood in 10 minutes; we question the truth of this story and certainly the advisability of recounting it without any further comment on the rate of blood transfusions. Plasma transfusion, which is now largely replacing blood transfusion in the treatment of shock, is just mentioned.

On the whole the new edition is disappointing. The book is a valuable one, and in view of the fact that there are few, if any, other books that cover the same ground, it is important and should be read widely in this country, especially in towns that may expect air raids, but the reviewer feels that it might have been better.

**EXPERIMENTAL PHYSIOLOGY FOR MEDICAL STUDENTS.**—By D. T. Harris, M.D., D.Sc., F.Inst.P. Third Edition. 1941. J. and A. Churchill Limited, London. Pp. xi plus 292, with 248 illustrations and plate in colour. Price, 15s.

THIS book, now in its third edition, is already familiar to many medical men who took their qualifying course in Great Britain, but it is, to their disadvantage, less familiar to students from the medical colleges of this country.

It is an ideal laboratory book for students doing their physiology course. In it a large number of appropriate and practical experiments, many of which can be done with the minimum of special apparatus, are described, and the lines along which other experiments could be devised are suggested.

This edition contains a very excellent chapter on experimental pharmacology (by Dr. W. A. M. Smart) which is an extremely appropriate addition to a book on experimental physiology.

This is a book that will be found very valuable for teachers of physiology and pharmacology in India. If they do not feel able to recommend it as a class book, hesitating to add to the student's already heavy book bill, they will find it very valuable for their own use, as it is replete with suggestions for experiments very suitable for students in this country.

**RECENT ADVANCES IN THERAPEUTICS. PART II.**—By J. R. Goyal, M.B., B.S. 1941. Published by the Manager, The 'Medical News'. P. O. Box 81. Delhi. Pp. iii plus 225. Price, Rs. 3-8

LATELY, we reviewed the first part of this book, that was entirely devoted to sulphonamide therapy. The second part, just published, deals with vitamins, hormones and various therapeutic agents, viz, protamine zinc insulin, dilantin, prostigmin, etc. Concise notes or abstracts from recent publications have been put together, thus affording a bird's-eye view of the subject.

The selection is fairly good, but the amount of detail often appears to be out of proportion with the relative importance of the subjects.

Cautionary comments might have been incorporated with some of the abstracts, especially with reference to the claims of 96.3 per cent cures in blackwater fever

with *Cassia fistula*, rapid improvement following cholesterol therapy in advanced anaemia of pregnancy, and a few others.

There are many printing mistakes in the book; the errata list added at the end of the book is incomplete.

General practitioners who are not in touch with recent literature will, however, find these two booklets very helpful.

R. C.

**AIDS TO ANATOMY AND PHYSIOLOGY FOR NURSES.**—By Katharine F. Armstrong, S.R.N., S.C.M., D.N. (Lond.). 1941. Second Edition. Baillière, Tindall and Cox, London. Pp. xiv plus 384. Illustrated. Price, 3s. 6d.

I AM already well acquainted with the *Aids to Anatomy and Physiology*, and have circulated copies among my student nurses.

The book is unique in making these subjects interesting, and clearly summarizes all the knowledge needed by the nurses. It is simply set out, and is in my opinion adequate for the needs of the student nurse, without supplement from other books.

D. E. C.

**AIDS TO MEDICAL NURSING.**—By Margaret Hitch, S.R.N. 1941. Baillière, Tindall and Cox, London. Pp. x plus 375. Illustrated. Price, 3s. 6d.

*Aids to Medical Nursing* by Margaret Hitch is a valuable and essential addition to the series. It gives just the information on medical subjects that nurses need, with concise details of nursing care. This pocket-sized book should prove most helpful, both as a reference for those on duty, and for study for the final examination.

I shall have no hesitation in warmly recommending this book to both my student nurses and charge nurses.

D. E. C.

### CORRIGENDUM

In our July 1941 number on p. 440 in the review on *Materia Medica of Pharmaceutical Combinations and Specialities* by U. B. Narayanrao, reference was made to 400 patent medicines: the figure should have been 4,000.

## Abstracts from Reports

### ANNUAL REPORT OF THE KING EDWARD VII SANATORIUM, BHOWALI, U. P., FOR THE YEAR 1940

THE sanatorium remained open throughout the year and the accommodation available was fully occupied except during the winter months and, as usual, there was a waiting list during the season especially for the cheaper classes. Enquiries and applications for admission were received not only from the various districts of U. P. but from other provinces also.

Seventy patients remained in the sanatorium on 1st January, 1940, from the previous year and 252 patients were admitted and 274 discharged during the year under report. The daily average number of patients treated was 112.67, the largest number being 145 during the months of June, July and September, and the lowest 48 in the month of December.

The financial condition of the sanatorium remained satisfactory.

The need of water for the sanatorium has been felt very keenly for some time. While the quantity of water available has remained the same, the accommodation for patients has gone up from 18 in 1912 when the sanatorium was opened to 162 in 1940. Great difficulty is therefore being felt in supplying a sufficient quantity of water to the staff and patients. The question of sanitation is always closely bound up with

the supply of water and during the dry season when enough water is not available, it is found difficult to clean the drains and latrines thoroughly.

The urgent need of electricity in the sanatorium has been shown from year to year. The sanatorium requires electricity not merely for the sake of comfort to the patients but also from the point of view of efficiency and hygienic considerations. No sanatorium can be called up-to-date in these days without electricity when so much depends upon it such as x-ray, ultra-violet ray treatment, radio, etc.

The present generating plant consisting of an engine and dynamo for running the x-ray apparatus is showing signs of deterioration. The storage battery consisting originally of 60 cells was already small for the purpose for which it was meant when installed in the year 1931, and now it has become still less efficient owing to the disconnection of several cells on account of plate and other defects as a result of which a serious limitation has been imposed on the use of instruments and appliances dependent upon electric current, such as, the ultra-violet ray lamp, viewing boxes for studying the x-ray films, radio set, etc. During winter months the development of x-ray films has become very difficult because tank heaters cannot be used.

#### SECOND TRIENNIAL REPORT OF THE GOVERNMENT TUBERCULOSIS CLINIC (COLVIN HOSPITAL), ALLAHABAD, U. P.

DURING the year 1940, 1,139 patients were visited and 409 contacts were examined. The 'home' and not the 'family' was considered as the basis for investigation of contacts. From amongst the contacts about 25 per cent were found suffering from tuberculosis. These figures are high compared to English and other Indian figures. There may be some divergence on account of the standards of diagnosis; for instance a child contact aged 6 years with Mantoux (++) and having a few deep glands in the posterior triangle but not having any rise of temperature above the normal will be diagnosed scrofulous at one clinic and healthy at another. It is not always possible to observe the contact for a period before making a diagnosis. However in future it might be a better plan to separate a group of suspicious cases from those found definitely suffering from tuberculosis. A majority of cases disposed of their sputum in a satisfactory manner though a minority continued to be unsatisfactory.

#### SECOND ANNUAL REPORT OF THE TUBERCULOSIS ASSOCIATION OF INDIA FOR THE YEAR 1940

IN presenting this second annual report, we would express at the outset our pleasure at the thought that circumstances have made it possible for Her Excellency the Marchioness of Linlithgow to remain with us for another year and that the Association will continue to derive the benefit of her inspiration and guidance for that period. Her Excellency's close and personal interest in the anti-tuberculosis campaign gives momentum to the work of planning and establishing anti-tuberculosis institutions at the centre as well as in the Provinces and States.

In spite of the fact that the country's interest and energies have been concentrated upon the successful prosecution of the war, the year 1940 has seen a consolidation of the Association's existing activities and of progress in several new directions.

The establishment of a Central Anti-Tuberculosis Clinic in Delhi, which was envisaged in the appeal launched by Her Excellency for the King Emperor's Anti-Tuberculosis Fund, is now an accomplished fact; the Kasauli Sanatorium project has been accepted, the estate has been taken over, and the construction is well advanced; the number of Provincial and State Tuberculosis Associations has increased; while a number of new institutions for the treatment of tuberculous

patients have opened or are in the process of opening throughout the country. An account of the activities generally of the Tuberculosis Association of India is recorded.

[This report, only in its second year, has grown to a volume of 131 pages, including the appendices. This in itself is clear evidence of the steadily increasing activities of the Association, but its size prevents adequate abstraction so we have confined ourselves to reprinting the introduction which gives a broad outline of its main advances. All workers on tuberculosis in India and others interested in the subject are recommended to obtain a copy of the report and read it for themselves, for in its pages they will find much information and encouragement to continue and still further increase this valuable work.]

#### REPORT OF THE MAYAVATI CHARITABLE HOSPITAL, MAYAVATI, ALMORA, HIMALAYAS, FOR 1940

THE Mayavati Charitable Hospital came into being as a sheer necessity—in fulfilment of the local needs. The regular dispensary was opened in 1903. Since then it has been growing in size and importance. Now quite a large number of patients come from a distance of even 50 or 60 miles, taking 4 or 5 days for the journey.

The hospital stands within the precincts of the Ashrama, and is in charge of a monastic member qualified for the task. There is also a medical graduate who was appointed to increase the efficiency of the work. Service is done in a spirit of worship, and as such irrespective of caste or creed. The efficiency with which the work is done has elicited admiration from one and all. Especially medical persons, having the practical knowledge of running a hospital have appreciated the management of the institution situated in such a distant corner of the Himalayas.

In the hospital there are 13 regular beds, one extra bed being added this year. But sometimes we have to make arrangements for even 30 or more indoor patients.

The operation room is fitted with up-to-date equipment and almost all kinds of operation can be done here.

We have also got a small clinical laboratory.

There is arrangement for the amusement and recreation of the patients through a gramophone. There is also a small library for those who can read.

The following figures will indicate the gradual growth of the hospital:—

Year	NUMBER OF PATIENTS	
	Outdoor	Indoor
1915 .. ..	1,173	
1925 .. ..	3,162	35
1930 .. ..	5,014	203
1935 .. ..	14,344	189
1940 .. ..	14,312	286

#### THE ASSAM MEDICAL RESEARCH SOCIETY, SHILLONG: A RESUME OF ITS ACTIVITIES DURING 1931-41. ILLUSTRATED. PUBLISHED BY MESSRS. THACKER, SPINK AND COMPANY (1933), LIMITED, 3, ESPLANADE EAST, CALCUTTA

THE introduction to this publication gives a short account of the genesis of the Society which we quote in full.

The Society was the result of negotiations which had been going on since 1927 between the Assam Branch, British Medical Association, the managing committee of the Pasteur Institute, the Government of Assam with the Medical Research work in the province. In its final form the Society owes its inception to Sir Egbert Laurie Lucas



Hammond, K.C.S.I., C.B.E., I.C.S., the then Governor of Assam, who was pleased to become its first Honorary President and to Lieut.-Colonel J. Morison, C.I.E., M.B., D.P.H., I.M.S., who was then Director of the Pasteur Institute, Shillong.

An informal conference was held at Shillong on Tuesday, the 16th September, 1930, under the chairmanship of the Hon'ble Minister, Local Self Government, Assam (the late Rai Bahadur K. L. Barua), to discuss the possibility of forming a Society to press forward the investigation of malaria and other epidemic diseases. Members of the legislature, representatives of the Government and of the agricultural, industrial, transport and other interests and of the non-official public attended the above conference and discussed the scheme formulated by Colonel Morison, the (then) Director of the Pasteur Institute, for the above purpose. After further consideration both by the industrial interests and by the Government, a communiqué was issued by the Government of Assam on the 17th February, 1931, notifying the formation of a Society registrable under the Societies Registration Act of 1860 under the name of the Assam Medical Research Society the objects of which would be the prosecution and assistance of medical research and investigation in connection with the causation, mode of spread and prevention of communicable diseases in Assam (and adjacent parts of India) and malaria in particular, the dissemination of knowledge acquired and the furtherance of experimental measures against these diseases. Members of the first Governing Body representing the various interests were nominated by His Excellency the Governor of Assam.

The Society has now been in existence for about 10 years and a report on its activities from year to year has been furnished to the Governing Body and its constituents. As the future of the Society is rendered somewhat uncertain owing to the termination of the grant from the Government of India made through the Indian Research Fund Association with effect from 1st April, 1942, a brief résumé of the activities of the Society covering its period of existence over the last 10 years is now submitted for the consideration of the Governing Body and the constituents in order to enable them to arrive at a decision as regards its continuance in its present or modified form or the maintenance of the continuity of work by other means.

Then follow two parts giving a summary of the work performed throughout this period. The principal work has been in connection with malaria control and cholera prevention, "and as we have regularly abstracted from the annual reports every year we do not propose to refer to them further here. There is a fourth part headed 'Conclusion' giving a further account of certain special aspects of the work, and finally in an appendix there is a summarized statement of receipts and expenditure.

It is an interesting record of valuable work and in later years will undoubtedly prove of historical interest when the Society is older and its origin and early work is less well remembered than it is to-day.

#### ANNUAL REPORT OF THE MALARIA ADVISORY BOARD, FEDERATED MALAY STATES, KUALA LUMPUR, FOR THE YEAR 1940. BY A. NEAVE KINGSBURY, CHAIRMAN

PRELIMINARY findings by the Malaria Research Division, Institute for Medical Research in regard of M3—a preparation manufactured by the State Biochemical Institute of Milan—were included in the previous report. The manufacturers claim that the drug has a curative action in chronic malaria and that its prophylactic value is greater than that of quinine. They allege that a single course of a month's duration confers immunity from malaria for six months. The Senior Malaria Research Officer reported the final results of M3 prophylaxis on a population of 100 over a period

of six months. Briefly, the preventive action was less than that of a single weekly dose of 1.0 gm. of quinine—a known inefficient dose. Furthermore there was no evidence that the drug stimulated the development of malaria immunity.

#### 'ALEBRIN'

The preparation 'Alebrin' was also brought to the notice of the Board. This synthetic compound, manufactured by an Indian firm, is claimed to be of value in malaria. It is a yellow solid said to be a derivative of benzo-dihydrochloride-methoxydiamino-acridine. The trade leaflet issued by the manufacturers states that it is twenty times stronger than quinine. The appearance is very similar to that of atebirin in the form and colour of the tablet, the type of packing, the leaflet of instructions and the design of the package. A supply of 'Alebrin' sufficient for three courses of treatment was received in October last from a local drug house; two cases of acute *falciparum* malaria and one case of acute *vivax* malaria were given the full course of 0.3 gm.  $\times$  5, recommended by the manufacturers. The Senior Malaria Research Officer found that the response to treatment was slow; in the two 'Alebrin'-treated cases of *falciparum* malaria, asexual parasites persisted in the peripheral blood for eleven days—their elimination then was probably due to the quinine which, on account of the increasing number of parasites, it was necessary to give from the eighth day onwards. Fever disappeared during alebrin treatment, but more slowly than with quinine; in one case fever recurred on the eighth day. In the *vivax* malaria case, parasites remained in the peripheral blood for three days longer than in the quinine-treated case; fever for one day longer. This action is not that of an efficient drug. With efficient quinine treatment parasites very rarely persist beyond the seventh day. Three cases do not provide a sure basis for a dogmatic statement on the efficiency of a drug in malaria but there can be little reasonable doubt that whatever may be the value of 'Alebrin', it is much less effective than quinine.

## Correspondence

#### A NOTE ON COMPLEMENT-FIXATION TEST IN LEPROSY AND KALA-AZAR WITH WITEBSKY, KLINGENSTEIN AND KUHN (W.K.K.) ANTIGEN

Sr.—In your August number you publish 'A note on complement-fixation test in leprosy and kala-azar with Witebsky, Klingenstein and Kuhn (W.K.K.) antigen' by Greval, Chandra and Das in which the authors indicate that the test with the W.K.K. antigen is of considerable value in the diagnosis of leprosy, and possibly in prognosis and in studies of aetiology and epidemiology. A thorough study of this test carried out in this department has led to very different conclusions.

The work on this antigen was initiated in 1938 after the report of various workers chiefly in South America that the W.K.K. antigen frequently gave complement fixation in cases of leprosy and also in cases of kala-azar. In the early phases of the work we had the collaboration of Colonel Greval. The technique of the test was modified (Greval, Lowe and Bose, 1939) and the results of the test were studied in 250 cases of leprosy, 20 cases of kala-azar and 92 cases of other diseases (Lowe and Greval, 1939). Later, Dharmendra and Bose (1941) working in this department thoroughly studied complement fixation in leprosy with antigens prepared from various acid-fast bacilli by various methods including that of Witebsky, Klingenstein and Kuhn.

The article by Lowe and Greval reported that the results of complement-fixation test were found to



correspond very closely with the results of ordinary bacteriological examination for *Mycobacterium leprae*, but since bacteriologically-positive cases form only a small proportion of the total, and since diagnosis of such cases by other methods is easy, the value of the test in diagnosis was little. Its value in prognosis also appeared to be little. The article also reported positive results in 18 of 20 cases of kala-azar and doubtful or negative results in nearly all of 92 cases of other diseases.

The article by Dharmendra and Bose showed that complement fixation could be obtained in bacteriologically-positive cases of leprosy with a large number of antigens prepared by various methods from almost any acid-fast bacillus, pathogenic or otherwise, and that there appeared to be little specificity about the reaction.

Further work on immunological tests in leprosy (allergic skin tests, and complement-fixation tests after absorption) has suggested that the complement fixation seen in leprosy with various antigens may not be a true immunological reaction at all.

I will outline the bearings of these findings on the use of the W.K.K. antigen in leprosy.

(a) *Diagnosis*.—The W.K.K. antigen gives results in bacteriologically-positive cases, which here form only about 20 per cent of the total, and in which diagnosis by other methods is much easier, quicker and more generally practicable. Its value in diagnosis therefore appears to be very little, and we have never even thought of using the test for this purpose.

(b) *Prognosis*.—Our limited observations in the possible prognostic value of the test has demonstrated marked limitations. It will not even differentiate between the bacteriologically-positive neural cases with a good prognosis, and the lepromatous cases with a bad prognosis. We have therefore not undertaken a further study of this matter.

(c) *Ætiology and epidemiology*.—It has been shown that the test is of no value in establishing the genuineness of organisms isolated from leprosy material. It is therefore of no value in studying ætiology from the bacteriological aspect. In studying the wider aspects of ætiology and epidemiology, the lack of specificity and the doubtful significance of the test would appear to render it of little value. Already simpler and better immunological methods are available.

So far I have dealt only with the main lines of the article by Greval, Chandra and Das as far as they apply to leprosy. There are many details which call for comment but I will deal with only one, namely, the statement that in diagnosis, doing a complement-fixation test is easier than 'removing bits of tissue for the microscope'. In cases that give a complement-fixation reaction, clinical diagnosis is usually very easy; and if microscopic confirmation is needed, a 'slit smear' can be taken and examined in a few minutes. The above statement is therefore very misleading.

The finding that complement fixation can be obtained in bacteriologically-positive cases of leprosy with antigens prepared from acid-fast bacilli by a variety of methods, and used in high dilution, is an interesting observation, but its practical value is very little.

JOHN LOWE.

LEPROSY RESEARCH DEPARTMENT,  
SCHOOL OF TROPICAL MEDICINE,  
CALCUTTA,

2nd September, 1941.

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GREVAL, S. D. S., LOWE, *Ibid.*, **26**, 843, J., and BOSE, R. (1939).  
LOWE, J., and GREVAL, *Ibid.*, **26**, 833, S. D. S. (1939).

#### VIPER VENOM IN A CASE OF RECURRENT HÆMORRHAGE IN THE VITREOUS

SM.—In the *Indian Medical Gazette* for April this year (p. 221) I reported a case in which viper venom was successfully used in the treatment of recurrent hæmorrhage in the vitreous, the treatment ending in August 1940.

In April 1941 the patient insisted on a second course of viper venom as a preventive against relapse. I consented and gave him a first dose of 1 c.cm. of diluted viper venom intramuscularly. Within 10 minutes he exhibited a strong allergic reaction—flushed face, general urticaria, rapid pulse, etc.

Adrenalin was not administered because it is contra-indicated with viper venom (see notes from Haffkin Institute on viper venom in tooth bleeding).

He recovered in about an hour with rest, applications of cold water and lying under an electric fan.

No after effects were reported to me, but I have since been notified by his family physician that the man died in May of this year from uræmia. His vision was good until his death.

K. N. PRADHAN, L.M.S. (Bom.),  
B.Sc. (Nag.).

THE PRIVATE HOSPITAL,  
AMRUT BUILDING,  
MAIN ROAD, SITABULDI,  
7th August, 1941.

#### CONGENITAL MALARIA

SM.—In the *Practitioner* for May 1941 on page 339, Dr. Cooke, Physician in charge of out-patients, Hospital for Tropical Diseases, London, states 'it should be remembered that malaria can be transmitted via the placenta'. On page 135 of the third edition of combined *Textbook of Obstetrics and Gynecology*, 1939, published by Livingstone, it is stated 'The malarial parasite never passes from the mother to the fœtus'. Which statement is one to accept and believe? Since there is at no time any connection or continuity between the maternal and fœtal circulations, and the interchanges between them (mother and fœtus) take place through the thickness of the villi and the walls of their vessels, is it usual (normal), or possible for the malarial parasite to pass from the one to the other through healthy intervening tissue?

One is perplexed at the above contradictory statements, so perhaps you or some other authority would clarify things through the medium of the *Gazette*.

J. CHINAL, M.D., D.T.M.

P. O. BASDEOPUR,  
MONGHYR DISTRICT,  
E. I. RAILWAY,  
31st August, 1941.

[Note.—Whilst Dr. W. E. Cooke's statement is strictly correct, it is, we consider, misleading; on the other hand, the statement in the gynecological textbook, if it is unqualified by its context (we have not looked it up), is not true, but conveys the correct idea, namely that under normal conditions the malarial parasite does not pass from the maternal to the fœtal circulation.

We refer our correspondent to a paper by Professor B. M. Das Gupta that appeared in this journal in July 1939 (page 397). The question is very well answered here.

Many cases in which the child was quite evidently infected before birth have been reported, though it is relatively a very rare occurrence. There is no evidence at all that the parasite is capable of penetrating the membrane that separates the maternal and fœtal circulation, but, as this membrane is very thin and very extensive, its rupture, as a result of trauma or some localized lesion, is not an unlikely accident.—EDITOR, *I. M. G.J.*

## Service Notes

### APPOINTMENTS AND TRANSFERS

The services of Lieutenant-Colonel R. N. Bhandari, Superintendent, Central Prison, Agra, have been placed at the disposal of the Government of India, Defence Department, with effect from 6th July, 1941.

Lieutenant-Colonel N. S. Jatar, C.I.E., D.S.O., returned to duty before the expiry of his leave and resumed charge of the office of the Inspector-General of Prisons, Central Provinces and Berar, on 7th July, 1941.

Lieutenant-Colonel A. S. Garewal, officiating Inspector-General of Prisons, Central Provinces and Berar, has been reposted as Superintendent, Central Jail, Nagpur, from 8th July, 1941.

The services of Lieutenant-Colonel M. A. Jafary, Superintendent, Central Jail, Lucknow, have been placed at the disposal of the Government of India, Defence Department, with effect from 8th July, 1941.

The services of Lieutenant-Colonel J. B. Vaidya, Civil Surgeon, Benares, have been placed at the disposal of the Government of India, Defence Department, with effect from 13th July, 1941.

The services of Lieutenant-Colonel J. C. Bharucha, Principal, Medical College, Agra, have been placed at the disposal of the Government of India, Defence Department, with effect from 15th July, 1941.

Lieutenant-Colonel S. L. Bhatia, M.C., Principal, Grant Medical College, and Superintendent, J. J. Group of Hospitals, Bombay, has been appointed as Additional Deputy Director-General, Indian Medical Service, and has been transferred from this Province, with effect from the afternoon of 7th August, 1941.

Lieutenant-Colonel J. M. Shah, M.B.E., I.M.S. (Retd.), has been re-employed and appointed as Superintendent, J. J. Group of Hospitals, Bombay, with effect from the afternoon of 7th August, 1941.

On his reversion to military duty Lieutenant-Colonel D. R. Thomas, O.B.E., Chemical Examiner to Government, Punjab, made over charge of his duties to a non-I.M.S. officer on the afternoon of the 12th August, 1941.

Lieutenant-Colonel S. L. Patney, Superintendent of the Presidency Jail, Alipore, made over executive charge of the Jail to Mr. Chas. A. W. Luke on the afternoon of the 16th August, 1941.

Lieutenant-Colonel K. S. Thakur made over medical charge of the Alipore Central Jail to Dr. Bankim Behari Roy on the afternoon of the 23rd August, 1941.

On his reversion to military duty, Lieutenant-Colonel P. A. Dargan, Civil Surgeon, Amritsar, made over charge of his duties to a non-I.M.S. officer on the afternoon of the 14th August, 1941.

Lieutenant-Colonel B. Z. Shah, I.M.S. (Retd.), has been re-employed and appointed as Superintendent, Central Mental Hospital, Yeravda, with effect from the forenoon of 21st August, 1941.

The services of Major D. MacD. Fraser, Civil Surgeon, Naini Tal, on return from leave, have been placed at the disposal of the Government of India, Defence Department, with effect from 7th June, 1941.

The services of Major J. H. Boulton, Civil Surgeon, Agra, have been placed at the disposal of the Government of India, Defence Department, with effect from 8th July, 1941.

Major R. I. Reid is appointed as Director of Production, Instruments and Appliances, in the office of the Director-General, Indian Medical Service, with effect from the forenoon of the 19th July, 1941.

Captain H. B. Wright, Deputy Assistant Director-General (Medical Stores), Karachi, will continue to officiate as Additional Assistant Director-General, Indian Medical Service (Stores), until further orders, vice Major R. I. Reid, appointed Director of Production, Instruments and Appliances.

Captain F. R. Cawthorn is confirmed as an Agency Surgeon, with effect from the 5th May, 1941.

The undermentioned Lieutenants (on probation) are confirmed in their rank, subject to His Majesty's approval:—

### LAND FORCES (INDIAN MEDICAL SERVICES)

#### (Emergency Commissions)

3rd August, 1940

W. H. S. St. John-Brooks.	W. R. Smith.
J. M. French.	G. C. Tresidder.
M. Shaw.	R. H. Vasey.

The undermentioned officers (on probation) are confirmed in their ranks:—

### INDIAN LAND FORCES (INDIAN MEDICAL SERVICE)

#### (Emergency Commissions)

15th November, 1940

Captain C. V. Ramchandani.

2nd December, 1940

Lieut. M. K. Chaudhary. Lieut. M. A. R. Chaudhari.

2nd January, 1941

B. S. Dhillon.	N. C. Mehra.
A. A. Qureshi.	K. Rajamannar.
M. A. Shakur.	S. D. N. Anand.
Gopal Singh.	S. S. Nagi.
H. Khan.	T. S. Row.
A. H. Khan.	K. K. Jaswal.
N. F. Shaikh.	M. A. K. Khokhar.
T. M. Asani.	A. R. Sethi.
T. Banerjee.	H. M. Kalapesi.
S. G. Deosthali.	G. Hassan.
M. L. Bhagata.	S. K. H. Uraizy.
M. P. N. Nambiar.	H. S. Dhillon.
D. B. Doctor.	K. B. Taneja.
M. Bhattacharjee.	N. S. Ahluwalia.
A. G. Rose.	J. Singh.
Gajinder Singh.	T. Singh.
D. S. Rege.	S. L. Abhayankar.
J. Krishnamurty.	A. P. Dube.

3rd January, 1941

T. C. John.

15th January, 1941

K. A. L. Bungash.	E. R. Menon.
S. C. Bose.	B. Singh.
A. Hasan.	H. Das.
W. A. Nandedkar.	N. Krishnaswami.
P. M. Bhandarkar.	R. L. Pathak.
A. Das.	L. N. Bakshi.
N. S. Gaitonde.	M. R. Thapliyal.
A. M. Chakravarty.	S. Kesavulu.
B. M. Pattanayak.	M. A. Nair.
S. Roy Chowdhury.	K. S. Bhushanam.
H. C. Dhawan.	S. Ghaneswarani.
E. Edwards.	T. V. Ranganathan.
K. K. Bhatt.	P. S. Dorai Raja.
G. J. Bhatt.	P. R. Saksena.

S. M. Qureshi.

16th January, 1941

A. S. Choudhuri. C. J. David.

C. L. Bhatia.

### LEAVE

Lieutenant-Colonel M. A. Singh, Inspector-General of Prisons, Bengal, is allowed leave for 16 days from the 6th October, 1941.

Captain W. M. Niblock, 2nd Resident Medical Officer, Presidency General Hospital, Calcutta, is granted leave for 19 days, in extension of the leave already granted to him, i.e., 6 weeks from 16th June.

### PROMOTION

#### INDIAN MEDICAL SERVICE

#### Lieutenant-Colonels to be Colonels

G. Covell, C.I.E. (superannuated). Dated 1st June, 1941, with seniority from 31st July, 1936.

H. E. Shortt, C.I.E. Dated 8th July, 1941, with seniority from 30th January, 1933.

*Major to be Lieutenant-Colonel*

P. V. Karamchandani. Dated 26th August, 1941.

*Captains to be Majors*

1st August, 1941

J. D. Murdoch. A. T. Andreassen.

4th August, 1941

D. G. McCaully.

6th August, 1941

R. K. Muir.

13th August, 1941

W. S. Morgan.

20th August, 1941

M. S. Purvis. M. E. Kirwan.

## INDIAN LAND FORCES

*(Emergency Commissions)**Lieutenants to be Captains*

1st August, 1941

D. P. Puri.	N. A. Kuraishy.
R. S. Saksena.	M. Das Gupta.
M. Ramarao.	A. G. Menon.
P. C. Nedungadi.	C. L. Chadha.
K. P. Anandan.	H. L. Anand.
M. Y. Qureishi.	W. G. Aranha.
K. M. Singh.	L. B. Belkhole.
S. N. Sharma.	P. Chandra.
H. L. Sah.	N. C. Chatterjee.
F. P. Gazdar.	N. G. Gadekar.
S. P. Mukherjee.	A. Qadir.
A. Nath.	A. K. Gupta.
H. A. Davidson.	N. Dutt.
R. S. Dhillon.	M. R. Vesuna.
R. K. Satija.	G. C. Chawla.

2nd August, 1941

P. Oommen. S. C. Banerjee.

K. C. Chaudhuri. S. M. Das.

S. K. Roy.

3rd August, 1941

W. H. S. St. John-Brooks.	W. R. Smith.
J. M. French.	G. C. Tresidder.
M. Shaw.	R. H. Vasey.

15th August, 1941

C. N. Chatterji.	H. C. Sen Gupta.
K. B. Roy.	J. Sen.
M. A. Razak.	P. Singh.
P. L. Khurana.	A. Dhirar.
E. K. Pillai.	M. Suleman.
S. K. Misra.	N. L. Sharma.
A. Chattopadhyay.	P. Z. Abraham.
P. K. Das.	B. L. Aggarwal.
G. S. Lamba.	V. S. Sharma.
P. K. Paul.	M. M. Sharif.
T. V. R. Wariyar.	S. Prakash.
R. S. C. Banerji.	C. Bhan.
G. S. Dhaliwal.	K. C. Majumdar.
C. T. Subrahmanyam.	G. Kumar.
R. K. Chatterjee.	H. S. Malik.
R. S. P. Sinha.	K. S. Rama Swami.
S. M. Venkatakrishnan.	I. A. Sahibzada.
S. N. Bose.	J. N. Dhar.
S. Pichumani.	M. Alam.
A. Islam.	G. A. Aleem.
U. P. Das Gupta.	B. K. Goswami.
J. Jacob.	V. F. Siqueira.
B. Barat.	J. C. Sen.

16th August, 1941

N. V. Sridharan.	P. B. Bose.
S. N. Bose.	S. K. Das.

S. C. Chatterjee.

17th August, 1941

I. B. De.

## RETIREMENTS

Major-General (local Lieutenant-General) W. H. Hamilton, C.B., C.I.E., C.B.E., D.S.O., K.H.P. Dated 12th July, 1941.

Lieutenant-Colonel H. Chand, M.C. Dated 26th August, 1941.

Lieutenant-Colonel N. J. Gai. Dated 26th August, 1941.

Lieutenant-Colonel C. M. Ganapathy, M.C. Dated 1st September, 1941.

## Notes

## DEXTROSOL

THE place of dextrose (d-glucose) in health and disease has of late received considerable attention in the medical press; the following three booklets that have been issued by Corn Products Company are sure to prove useful:—

‘The Therapeutic Use of Dextrose’ by Gaston Levy.

‘Dextrosol in the Pathology of Digestive Disorders.’

‘Advances in Treatment with Dextrosol.’

The three booklets give a very good idea of the protean pathological conditions in which glucose can be used with advantage. The sceptic might suggest that these include the whole range of human ailments, but this would be an exaggeration. It is however no exaggeration to say that in the very great majority of acute diseases the administration of glucose will help the patient. The remark also applies to many sub-acute conditions.

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## Original Articles

## OBSERVATIONS ON THE NAKED-EYE MANIFESTATIONS OF CHRONIC INFECTIVE PROCESSES IN THE ABDOMEN

By A. INNES COX

LIEUTENANT-COLONEL, I.M.S.

District Medical Officer, Madura

'READ not to contradict and refute; not to believe and take for granted; nor to find talk and discourse; but to weigh and consider.'—BACON.

It is unfortunate, but true, that many of us in India handle medical and surgical material of intense interest, and yet after years of experience have little to show for it, except official annual returns and mental impressions. It is not wholly our fault, for the pressure of work is immense, change of district, and frequent change of assistants necessitated by the exigencies of service tend to retard good intention. I plead guilty of this failure, yet feel constrained to set forth my mental impressions as they have grown strong by frequent repetition. I also gain encouragement by the knowledge that many respected colleagues over a number of years have confirmed my observations and agreed to the probability of the conclusions drawn from them.

Case records and scientific laboratory reports, I have none. To delve into the records of headquarter hospitals no longer in my district is to call upon others to do the work that I should have done myself. However, if the reader will condone this unscientific approach, maybe what follows will not be without interest as it offers a fresh explanation for some common abdominal diseases, and endeavours to explain others that are still obscure. The reader must take, with me, a very general view and regard the patient, his surroundings, habits and customs as an entity, and all that, against a time background. I wish particularly to emphasize the time factor, for I talk of chronic infections and not of the acute infective processes that are sudden and dramatic, although the chronic may become dramatic at any time, and so obscure the chronic origin. It must also be realized that all diseases have a degree of local variance, and I speak of south-west India, particularly of Malabar and Coimbatore.

I will discuss my observations in the order in which they have impressed themselves upon me.

1. The naked-eye appearance of old-standing inflammation of the appendix and of its effect on the intra-abdominal organs.

2. The naked-eye appearance of old-standing inflammation in the lower abdominal cavity other than that of appendicular origin and its apparent results.

3. The origin and scope of these different infective processes.

4. Deduction.

1. The appendix itself varies in appearance from a sclerosed dry strand of tissue to a long thick turgid oedematous structure. It may be of any shape and in any position, but, whatever its condition may be, there will be found, taking origin from it, a degree of lymphangitis which gives rise to a membrane formation. This membrane is highly vascular in the active stages, tough, and in places unyielding in the later stages; it is loosely applied to the surface of all the viscera that it encounters in its upward path; but it forms strong ligamentous attachments between the viscera. New glandular formation and enlargement of normal existing glands will be found according to the degree of inflammatory activity encountered during the laparotomy. It is not usual for the people of south-west India to resort to hospital for discomfort that does not incapacitate them, so the early stages of this membranous formation are not so commonly seen; what is usually seen is the result of years of a chronic inflammation which has resulted in complications.

I have attempted to sketch the general appearance (figure 1). The whole of the right

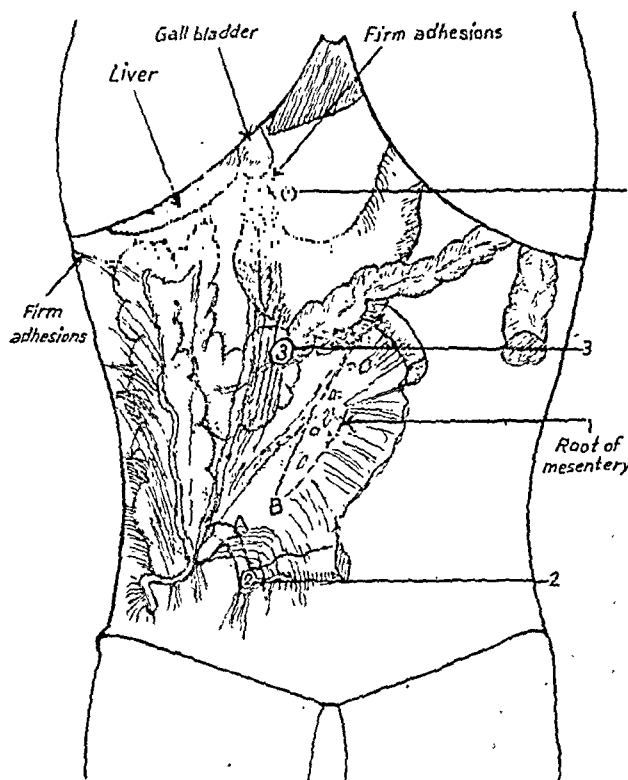


Fig. 1.—Sites marked (1), (2), (3) represent the three main sites of obstruction.

side of the abdomen is invested by a membrane, so tough in places as to appear ligamentous. This although closely applied to the underlying viscera, does not appear to be part of their peritoneal covering, for it can be separated from them to demonstrate its adventitious nature.

The terminal ileum is bound down, often to a degree that renders it unrecognizable until freed by Mayo's scissors. The cæcum ascending colon, hepatic flexure and the first third of the transverse colon are all invested. The pyloric end of the stomach and the first part of the duodenum are firmly bound to the under surface of the liver and gall bladder, and strong bands bind the large gut on the right side of the abdomen to the adjacent para-colic gutter. As this membrane toughens, the pyloro-duodenal junction becomes first fixed, and then kinked. The site of the kink is often the site of a so-called pyloric ulcer. This is obstruction no. 1 (figure 1).

The exaggerated Lane's kink due to the approximation of points A and B in the figure, by sclerosis, in the presence of a bound terminal ileum, is obstruction no. 2 and where the strong bands of membrane cross the junction of the first and second thirds of the transverse colon is obstruction no. 3. It must however be realized that the whole length of gut from site 2 to site 3 is hampered in its activity. It is often turgid and oedematous from lymphatic obstruction, and the exudation escaping from this part, added to the little free fluid usually found in the dependant parts of any abdomen, often amounts to some ounces and this on exposure to the air forms a gel, testifying to its inflammatory nature. So this too must be considered to be endowed with the power of adhesion formation, and the possible reason why an intra-abdominal lymphangitis gives rise to a sheet-like membrane.

This is the usual naked-eye picture encountered during the routine gastro-enterostomy for pyloric obstruction in a man of 45 years and over, with symptoms of 15 to 20 years' duration and whose condition is now rendered intolerable by virtue of obstruction no. 1. May the apparently large number of failed gastro-enterostomies not be due to the failure to appreciate, or permanently to overcome, obstructions at sites 2 and 3 whereby, undigested food, short circuiting obstruction no. 1, is held up at obstructions 2 and 3, giving rise to discomfort which the patient can no longer relieve by putting his fingers down his throat?

I have tried to find reference to this common state of affairs but the nearest approach to a description that I have been able to trace is a passage in Binney quoting Moynihan under the heading 'Cæcectomy'. I quote from memory as that reference is not available and so may be forgiven for not reproducing that lucid fluidity of writing that characterizes Moynihan. He says in effect that 'Sometimes the whole of the right side of the abdomen is found turgid and oedematous, affecting the cæcum, ascending colon and the first half of the transverse colon and for this I can think of no effective treatment other than hemi-colectomy'. I think that at some time Lord Moynihan must have recognized what I describe as commonplace in

South India, but what is in England, I presume, much less common. I have been tempted to do an ileo-transverse colostomy in such extreme cases, as such appears reasonable, but the patients are poor surgical risks and dislike operation by stages.

I am satisfied that the kinking described as obstruction no. 1 can be, and is, the site of ulceration. Ulceration behind an obstruction is a habit in the alimentary canal. I am also equally satisfied that the thickening behind the kinked, bound obstruction is taken for pyloric ulcer with sclerosis even when there is no ulceration, for I have followed operated cases to the post-mortem room on several occasions and found no ulcer, but with the relaxation of death, a free passage. This error is more likely to occur with spinal and general anæsthetics than with local, although I hasten to add, it is not necessarily bad surgery to perform gastro-enterostomy if there be obstruction even in the absence of ulceration, so long as obstructions 2 and 3 are appreciated.

Now all that is said above will explain another common condition, namely, chronic gastric dilatation. I had one extreme case whose stomach during x-ray examination obscured every organ in the abdomen and pelvis. I kept him in hospital for over 10 months, when he died. Autopsy proved that there was no ulcer, but he did have a very tough membrane formation and evidence of long-standing appendicitis. Another such extreme case treated by gastrostomy and the passage of a tube through the pylorus remained happy until the tube came out and could not be replaced, and so he too died. But between the slight and the extreme, many cases of simple chronic gastric dilatation are seen in this part of India, and while painless because free of ulcer, yet give rise to extreme discomfort which the patient tries to relieve by belching and air-swallowing to enable him to belch more freely. (Perhaps the home practitioner may not realize it, but this is classical conduct in the part of India I speak of.) This too, I believe, is the result of the membranous lymphangitis rising from a chronic appendix, thickened into ligamentous attachment between the pyloro-duodenal junction, and the under surface of the liver.

The name volvulus is a loose one. If what I describe below is volvulus of the small intestine, then 4 out of 5 cases of intestinal obstruction (other than hernial strangulations) are in my experience, on the Western side of South India, volvulus of the small intestine.

The condition appears to be this. The appendix shows evidence of chronic inflammation resulting in sclerosis. The membrane described above is marked, and, as the lymphangitis is no longer active, it is now a contracting scar. The appendix may lie across the terminal ileum, either in front or by artifact, behind (the ileum being bound down and dragged down by scar contraction on top of it). The appendix and

cæcum are drawn up towards the root of the mesentery which, in its lower part, is puckered and contracted, more below near the appendix than above which is the root of jejunum. There is a degree of small intestinal obstruction in the lower reaches of the ileum at the site marked obstruction no. 2 in figure 1, while above, the gut is hypertrophied and dilated. As a result there is a longer mesentery to the jejunum than to the ileum, the latter being scarred and puckered by its proximity to the appendix and old-standing lymphangitis at its base. Some day after a big meal, the weight of the upper gut bears it down and to the right, and the base of its mesentery lying over the scarred, fixed, lower mesentery *cum* appendix brings the jejunum towards, and even into, the pelvis. In this way the mesentery makes a half-turn anti-clock-wise that is clear to the eye at operation and is corrected only by complete eventration, when, the fixation of the cæcum *cum* appendix *cum* lower ileum having been relieved, the bowel resumes its normal position, the contents pass on and the patient (temporarily at all events) is cured (figure 2).

A highly situated appendix is at times described as due to failure in descent of the cæcum and ascending colon. This developmental failure cannot be considered a common occurrence as it is not commonly found in abdomens innocent of the pathology I shall shortly attempt to describe.

The appendix is, at times, plastered down on to the ascending colon, and so covered over by this lymphangitic membrane that it looks like one of the longitudinal striæ, and is only demonstrated to be the appendix by the surgeon dissecting it out.

The tip of the appendix may be right up under the liver and attached to it by a ligamentous thickening of this membrane. It may even be so attached to the gall bladder, that, by contracture of this membrane and the adhesion caused by it, the whole of the large gut in the right side of the abdomen is drawn up, so that to effect visualization and removal of the appendix the incision must be extended upwards to the maximum, and woe to the surgeon who has started work through the grid incision.

Once this state of affairs is acquired it is very doubtful if a patient is materially benefited by removal of an appendix that has itself long

since prohibited the ingress of any bowel content, for on slitting it up it is found to be thick-walled, tough, and innocent of any faecal content or of naked-eye evidence of active inflammation. But it has materially interfered with the free movement of the right half of the large intestine, duodenum and pylorus by virtue of the membranous formation resulting from years of chronic inflammation.

Appendicular gastralgia conveys the idea of a nervous reflex. I do not refer to this form of upper abdominal discomfort secondary to appendicitis, but to gastric or upper abdominal discomfort amounting to pain in the absence of obviously active appendicitis. One knows that a patient treated gently under a local anæsthetic does not greatly complain, but directly an organ is pulled upon he immediately resists or even cries out. In the condition described above with the pyloro-duodenal junction fixed to the liver and gall bladder, the colon fixed to the liver, and hypertrophy of these organs secondary to their hard work in overcoming obstruction,

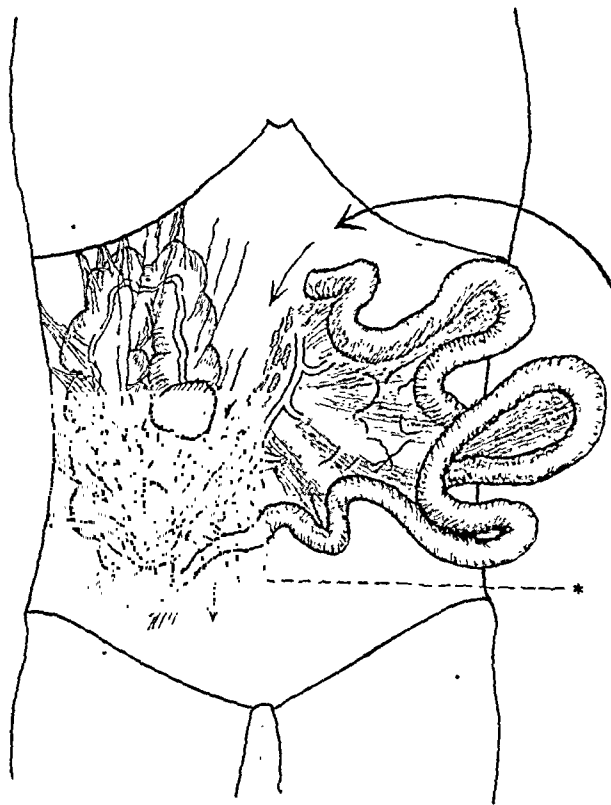


Fig. 2.—Diagram showing the shortening of mesentery of the terminal ileum and the relatively long mesentery to the jejunum predisposing to volvulus.

\* Terminal ileum bound down by sclerosed membranous adhesions. Strangulation over this fixed point.

it is easy to imagine a stomach contracting in its length as it goes into peristalsis so pulling on the gall bladder, wave after wave and pull after pull. Naturally, the patient resents this pulling on an organ. So I suggest that constant upper abdominal discomfort after food may be due to the stomach or, alternatively, the colon constantly pulling, as it were, on the gall bladder door bell. It is not unduly difficult, but laborious, to work through these tough



adhesions, but having done so how are they to be prevented from reforming? Hence, after removing a 'chronic appendix' for a gastralgia (there being no evidence of pathological lesion of the stomach) the patient complains that his old pain is still present, and so it will be, for all time, unless removal of the cause permits of stretching and elongation of the adventitious attachments this possibility I very much doubt, because they are seen so many years after, on re-opening what is diagnosed to be a failed gastro-enterostomy. In explanation of this discrepant diagnosis I advance my second point, which is essentially an attempt to show the similarity between the symptoms usually associated with the macroscopic appearances of abdominal pathology of appendicular origin, and similar appearances which, I suggest, arise from causes other than chronic appendicitis, so :—

2. When what is described above apparently affects both sides of the abdomen, where does the inflammation come from and what is the picture?

One sometimes finds evidence of a chronic inflammatory process more in the left side of the abdomen than the right, and in this case, the pelvic colon suffers the maximum change, and the change is identical with what is seen in the root of the mesentery of the small intestine as described above. The limb of the inverted 'V'-shaped root of the mesentery that extends lower into the pelvis bears the brunt of the change. It is scarred and contracted and has a watered-silk appearance. There may even be a bunch of hard glands as its base, which, invading the root of the mesentery, further shorten it. Above, the gut deriving attachment from the other and higher limb of the 'V' is dilated and hypertrophied and one recognizes the same predisposition to volvulus of the pelvic colon as described above as volvulus of the small intestine. In the later decades of life volvulus of this part of the gut occurs, and what I have described above are the naked-eye findings sketched in figure 3.

On the right side of the abdomen one sometimes finds the appendix in a pocket of its own which is bounded laterally and below by the para-colic gutter and medially by the cæcum and terminal ileum. The roof, cut through to expose it, is formed by a false membrane often of surprising thickness. It is as if the appendix, squeezed out of the way, took no part in the proceedings, and, as if the cæcum contacted the para-colic gutter above it, the lymphangitic membrane jumped the potential gap, missed the appendix, and continued on its upward path towards the pre-aortic glands and upper and side abdomen.

Now, if one holds up the anterior abdominal wall and throws in a light, not infrequently one will see strands of vascular adventitious membrane arising from the internal inguinal ring on one or both sides. At times one even

finds that the omentum is adherent here, and when it is peeled off, a broken-down gland wedged in the internal inguinal ring, is easily delivered. The appearance is reminiscent of the fundus of the eye with all vessels radiating from the disc.

From one or both internal inguinal rings the same type of intra-abdominal naked-eye picture as described for the 'chronic appendix' is reproduced, and the same upper abdominal pathology faithfully copied, with fixation of the pylorus,

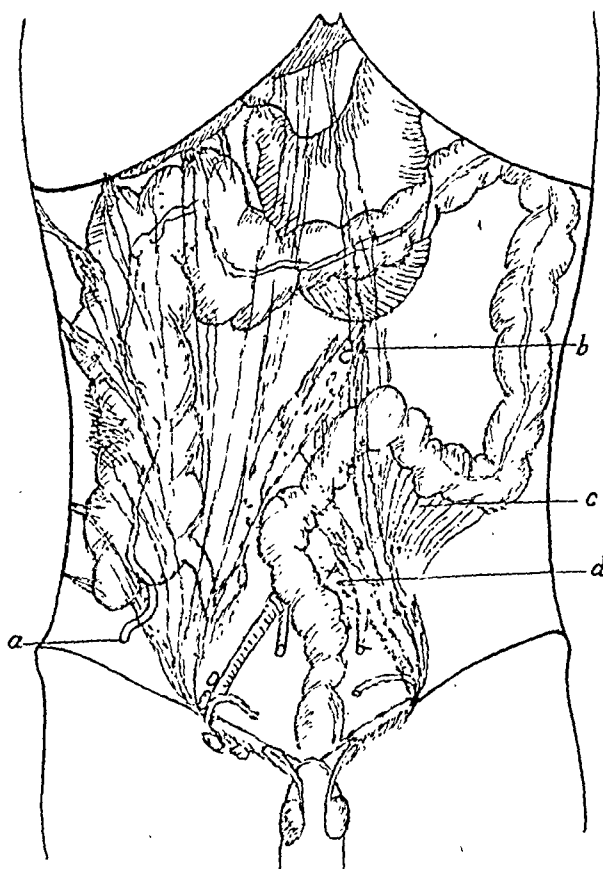


Fig. 3.—Diagram of appearance when infection apparently enters the abdominal cavity through the inguinal canal. The pelvic colon suffers in the same way as the small intestine shown in figure 2, and the same ultimate effect on the whole abdominal cavity is apparent.

a—Appendix apparently normal beneath the membrane.  
b—Root of mesentery.  
c—Normal long mesentery.  
d—Shortened scarred mesentery.

and the picture is as represented in figure 3, with all the signs and symptoms of chronic appendicitis and pyloro-duodenal ulcer or obstruction. That the infection originates at the internal inguinal ring is further supported by the common association of a mass of glands in the inguinal and even femoral regions, or for that matter the tell-tale scar, and also clinically one knows that acute gonorrhœa can simulate intra-abdominal disturbance, temporarily at least.

Now chronic infection arising from this site sometimes shows a state of affairs not seen in

that arising purely from the appendix. It may come from either or both sides. I refer to masses of glands which follow along the spermatic and iliac vessels to the pre-aortic glands and which seem to have a predilection for causing a massive adenopathy in part or all of the root of the mesentery. These glands, the size of pigeon eggs at the root of the mesentery, get smaller as they reach the free margin of gut and, blocking lymph flow render a section of gut œdematous and wooden, so much so that the state of affairs may go on to ulceration of the gut although this is comparatively rare, except in the cæcum. In other words the condition is indistinguishable by the naked eye from the various descriptions of regional ileitis or Crohn's disease, and this may occur anywhere from the pylorus to the cæcum, and again in the lower sigmoid and rectum, in fact in all the sites said to be commonly attacked by Crohn's disease (figures 4 and 4a).

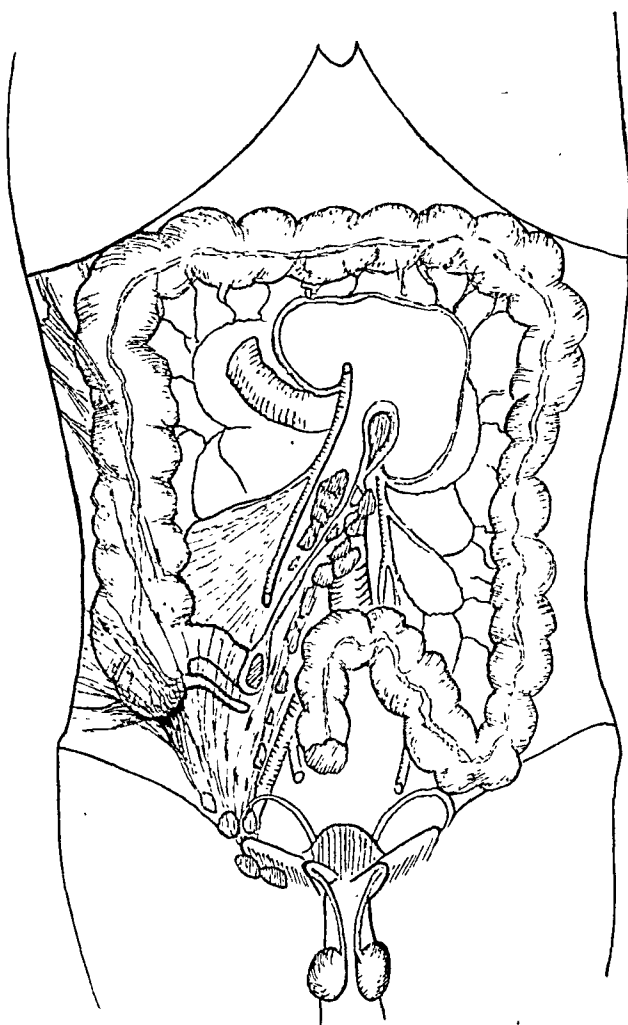


Fig. 4.—Mass of glands in part or whole of the root of mesentery giving rise to what looks like Crohn's disease.

In the cæcum the appearance is characteristic. The clinical history and diagnosis will certainly be tuberculous disease of the cæcum, and laparotomy will show a thick vascular membrane investing the terminal ileum, cæcum and

appendix, the whole, woody, hard, and intensely œdematous. It almost 'breaks' away from the cellular tissue of the posterior abdominal wall, and when slit up afterwards shows an inch or so of gut with a wall like ulcerated cartilage. Sent to the pathologist for cancer or tubercle, the result is neither. It looks, in fact, like the excised rectum of a non-malignant stricture of that organ. The resistance of the patient, unlike that in cancer and tubercle, is so good that death is rare, so further verification by post mortem is rarely possible, even if local custom permitted it.

When this state of affairs is found, the membranous formation is dense, and if the examining hand puts tension on the ascending and first third of the transverse colon and pylorus, dense thickenings of the membrane stand out as in figure 1. Any glands and tissue excised for biopsy do not disclose the true pathology, but do exclude active tuberculosis and cancer.

More rarely, frank tuberculous adenitis from a tuberculous lesion of the lower limb will give rise to similar membranous formation and moderate glandular enlargement, but this is more understandable, as the primary disease is

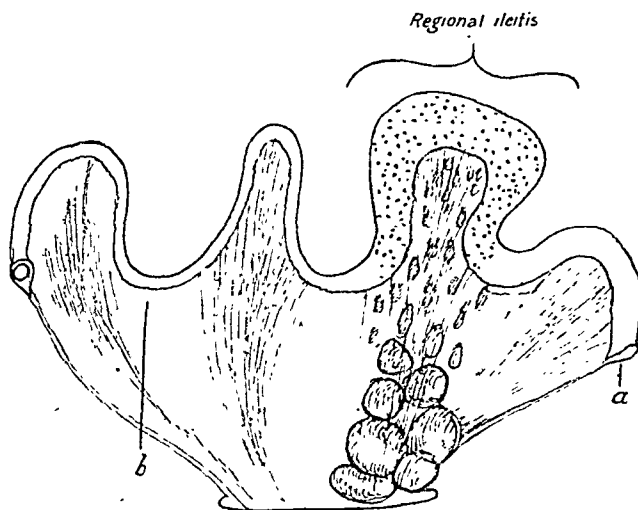


Fig. 4a.—Regional ileitis? A segment of intense œdema from lymphatic obstruction of part of the base of the mesentery.

a—Simple dilatation of healthy gut above the obstruction.  
b—Collapsed gut below obstruction.

recognizable. Mycetoma may show glands in the femoral and inguinal region which on section show characteristic discoloured areas, and so these give rise to no surprise. But my point is this:—Whatever the chronic infective process at work, the naked-eye appearance is similar, in general, namely, a more or less developed membrane formation investing the viscera in its path from the chronic infective focus, upwards, embarrassment of movement, lymph stasis and fixation of the viscera, especially the colon, to the side wall of the abdomen. Also fixation of the pylorus and first part of the duodenum to the under surface of the liver and gall bladder, kinking at the site of junction of these latter,

and all the symptoms of chronic appendicitis and pyloric ulcer with obstruction.

Moreover, and in particular, certain specific chronic infective processes may give rise, not only to the above, but to a variety of complications varying from Crohn's disease, to hydro-nephrosis from obstruction to the ureters where they enter the bladder.

3. *The origin of these different infective processes.* From the frequency with which people in this part of India suffer from chronic appendicitis, I suggest the following, more evident on the west coast where the disease is commonest. No one article of diet or vitamin can be blamed, nor hookworms nor water, but, I do think, adenitis can be blamed.

Diet in that part of India is almost devoid of protein. It is true many claim to be meat eaters, but on questioning them it is found that they get very little meat, or fish either. They get even less fish in the monsoon except a local dried variety, but few, however, will eat that.

Might it not be that the simple absence of protein from the diet means the absence of sufficient urea, that natural diuretic. In consequence there is water retention, water-logging of tissue, susceptibility of water-logged tissue to low-grade infection, and hence the almost universal granular pharyngitis, chronic infection and hypertrophy of adenoid tissue, adenoiditis, enlarged tonsils, tonsillitis, Peyer's patchitis, appendicitis, all chronic not acute. This is only a suggestion, but it certainly is very striking to the doctor working amongst these people. It is rarely if ever possible to pronounce an appendix innocent when there is a typical pyloro-duodenal ulcer, or the symptoms of it without ulcer, and then the membrane described with its adhesions is invariably present. But in true gastric ulcer, which is much less common, it is equally rare to be able to find fault with the appendix. The pathology of the two conditions *must* be different.

Can this membrane and glandular hypertrophy be attributed to chronic amœbiasis? I doubt it, for the splenic flexure escapes so consistently, and why only the right half of the abdomen? Chronic inflammation of the appendix must bear the blame for all the diseases above described as attributable to it, but not for the others.

What is the origin of the infection described as entering the abdomen by the internal inguinal ring and possibly the femoral canal, giving rise to anything attributable to chronic appendicitis, and, in addition, to much more, for instance, 'regional ileitis', tuberculosis of the cæcum that is not tuberculous, scarring of the mesentery and intestinal obstruction.

Climatic bubo heads the list, the tell-tale scar or history of bubo is the rule rather than the exception, although the history is not easy to obtain. A climatic bubo that failed to break

down is soon forgotten, especially if it occurred 30 years previously.

Occasionally on opening an abdomen for chronic obstruction, one finds a mass of glands occupying part or whole of the root of the mesentery. The segment of hard œdematous bowel overlying the mass may be so great as to present a danger to life if removal be attempted, yet this mass is apparently cleared by treatment with Foudadin or Fantorin, and the patient is relieved of his symptoms. This seems further clinical evidence incriminating climatic bubo.

As I write this article, I have been sufficiently fortunate to have 2 such cases admitted into hospital. These cases illustrate my point. Both were classical of high intestinal obstruction.

The first came under the care of my colleague Dr. Vadamalayan. Early operation was clearly necessary. On opening the abdomen two short lengths of jejunum were seen to be involved in an intense œdema, and the gut being stretched over masses of hard glands suffered a mechanical interference with the blood supply as well as obstructed lymph drainage.

The local involvement in the pathological process was so advanced that even the gentlest manipulation caused rupture, so two short resections were necessary.

As much of the gland mass as could be removed with safety was dissected out and a specimen sent to Madras for pathological report. The report was non-tuberculous chronic inflammatory tissue, suggesting regional ileitis. Thereafter Fantorin was given.

The second case was identical, except that the gut was not so seriously damaged by pressure of the gland mass on the vascular supply. The œdema was however very firm.

The sketch, figure 5, was made immediately after the exploratory laparotomy and is self-descriptive.

In this case no surgical procedure was carried out, and after demonstration, the abdomen was closed.

The patient was given Fantorin on alternate days and by the time that the stitches were removed, the hard mass, formerly visible through the thin abdominal wall, was no longer even palpable, and the patient was completely symptom-free.

The first, a female, could give no history.

The second, a male, admitted that he suffered 20 years ago from a swelling in the groin that lasted more than a year.

In this part of India, particularly on the coast, lymphogranuloma seems almost endemic. One meets with it in the neck, axilla, tonsil, floor of the mouth, bladder, lower ureters, rectum, penis, inguinal glands, in fact one is not surprised at any fresh manifestation. Many of these extraneous lesions are variously diagnosed as tuberculosis, cancer, or gummata and are treated for years with the usual remedies,

but are cured in as many weeks by Fouadin. If this external manifestations of lymphogranuloma be so varied, why should lymphogranuloma be excluded as a possible cause of intra-abdominal manifestation?

In paddy-growing areas men get cracked heels and chronic lymphadenitis from tuberculosis, mycetoma, and many unknown infections, all through their feet. May not such cases of chronic lymphadenitis of femoral and later also of inguinal glands, also be contributive to the prevalence of pyloro-duodenal ulcer and of all the lesions above described? It seems a long

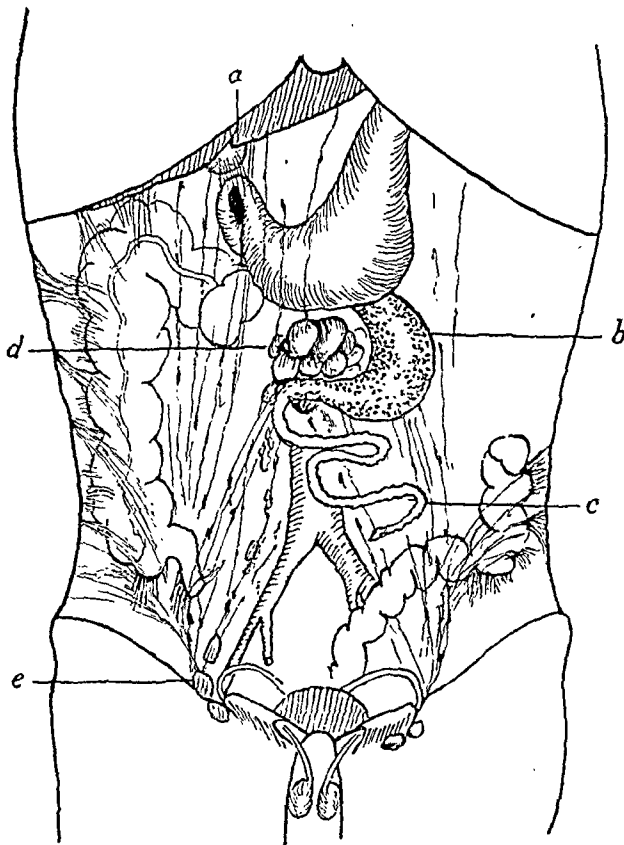


Fig. 5.

- a—Pyloro-duodenal junction firmly fixed to gall bladder.
- b—Duodenum and upper jejunum hypertrophied, dilated and intensely cedematous.
- c—Collapsed gut below obstruction.
- d—Mass of glands.
- e—Lymphadenitis giving rise to membrane by spreading over whole abdomen on both sides.

stretch from heel to duodenum, but, one sees the foot infections, the adenitis, the spreading intra-abdominal pathology, the hitching and fixation of pyloro-duodenal junction, and remember I said at the outset I am viewing the patient as a whole and not through a microscope.

This statement prompts me to make a further suggestion. If masses of glands be found in the abdomen, and if macroscopically at least, they appear to derive their origin from the internal abdominal or femoral ring, why should not the virus of infection extend to the mediastinum and answer the tuberculosis specialist's

query of what is that gland mass in the radiogram which is so unlike pulmonary tuberculosis?

One often sees a mediastinum showing massive 'glands' but no evidence of tuberculosis anywhere in the body, and no fever nor toxic quickening of the pulse. If the inner third of the lung field be covered, the outer two-thirds are seen to be clear. What then has drained into the mediastinal glands and from where? Certainly not from the lung tissue. There may be no evidence that the infective process travelled down from the deep cervical lymph glands, but, knowing that similar gland masses are stimulated to growth in the abdominal cavity, why not suggest that the same pathology may repeat itself in the mediastinum? This observation may escape the chest specialist for he seldom has the chance of seeing inside the abdomen. Neither does the abdominal surgeon think in terms of mediastinal glands and venereal diseases.

One occasionally does an exploratory laparotomy in a case of ascites from a medical ward if the patient be young, thinking that it is tuberculous and that the release of fluid and the inclusion of air will both establish diagnosis and be of therapeutic value.

These cases are occasionally surprises. The abdominal wall may be lined like the pleura is lined after years of effusion. The spleen may be enlarged, and attached by its margin to a similar lining membrane, quite different from anything above described, for here the membrane is hyaline in appearance and lines the parietes and not the mobile viscera. The liver also taking its part, is enlarged, or if later, contracted and cirrhotic. Glands may be present in abundance but on section they have not the naked-eye diagnostic features of tuberculosis. Such cases I have treated with Patterson's buttons, and because of success am an ardent supporter of Patterson's buttons. Perhaps I am not dealing with a tuberculous peritonitis at all but with a sarcoidosis. This introduces a fresh name.

Recently a highly-educated patient on full duty up to the day of admission came to the hospital with all the classical signs of high intestinal obstruction. He did not look as if he had suffered a long illness, his appearance was against a diagnosis of tuberculosis or cancer, but examination showed a protuberant abdomen and the presence of free fluid. Through this free fluid solid masses could everywhere be 'ballotted', the condition was considered hopeless but to satisfy conscience, the abdomen was opened to see if anything could be done.

Free fluid, innocent of any blood staining, escaped and the abdominal contents were as firmly fixed as if set in plaster of Paris. It did not look like tuberculosis of the abdomen, and if cancer, how did the patient survive so long? Exploration was impossible as everything was fixed. A small mass of this tissue was

broken off—not cut—it did not bleed. It proved to be a piece of omentum. Next day the patient died. Unfortunately Indian ideas and customs precluded a post mortem. So further investigation could not be made. The pathologist's report from General Hospital, Madras, was 'sarcoids', not cancer nor tuberculosis.

Now I am sure that pathological report was right. Very little attention has been paid to this disease, but the similarity between the manifestation of sarcoidosis as described, and the various manifestations of lymphogranuloma are very striking to the clinical observer. Of the microscopic differences, I know nothing, but for the benefit of those who see less of this condition than, I believe, we in the south-west India see, I will make a brief description.

Said to have been described by Jonathan Hutchinson in 1869, re-described by Besnier in 1899, more concisely described and in more detail by Boeck in 1899, ocular manifestations were described by Harfordt in 1909. Cutaneous manifestation reported from 1915 onwards, and since, practically every organ of the body has been found liable to suffer.

In an article in the *American Journal of Roentgenology* of April 1941 by Donald S. King, sarcoidosis of the spleen is described in which the spleen weighed 52 oz. and in the same article Teuben Schutz, pathologist, describes sarcoids in the lung, lymph nodes, and liver.

Sarcoidosis is a disseminated disease and the lesions are granulomatous, to all naked-eye appearance like lymphogranuloma in that there is gross lymphatic alteration and an œdema of wooden hardness.

The common occurrence of sarcoid-like diseases in this part of India in association with regional ileitis which looks like local sarcoids or alternatively lymphogranuloma, and the extreme frequency and variety of manifestations in which lymphogranuloma is met with is so striking, that it should be voiced even if only to stimulate the pathologist to classify these diseases and put them in their places. Clinically they appear to be one and the same disease.

Now and then a doctor hits on a new cure for cirrhosis of the liver. I cannot help thinking that he may have had the luck to run up against a small series of sarcoidoses, for this strange disease seems capable of a degree of resolution.

But since I am in my third section of this article dealing with origin of the infective foci, I put it as possible—indeed from a clinical point of view probable—that all forms of regional ileitis, woody cœcum, ano-rectal syndrome and so forth, together with sarcoids intra-abdominal and thoracic adenopathy associated therewith are none other than manifestations of the virus of lymphogranuloma inguinale (*alias* climatic bubo) mostly acquired but not infrequently congenital.

#### 4. Deduction.

The reader will have appreciated the general trend of ideas :—

(a) That in the abdomen, any low-grade infection over a period of time will give rise to permanent mechanical interference with the intra-abdominal organs, resulting in anything from pyloro-duodenal ulcer, to volvulus, and should therefore be eradicated early.

(b) That the same basic picture is reproduced whatever the exciting cause, whether the origin be in the appendix, or inguinal, or femoral canals.

(c) That in addition to this basic reaction, common to all chronic infective processes, certain specific organisms such as the tubercle bacillus or the virus of lymphogranuloma entering the lymphatic system of the lower abdomen will give rise to specific pathological pictures, such as tuberculous peritonitis, or woody cœcum and regional ileitis.

In result I suggest that the prevalence of chronic appendicitis, gastric complaints, volvulus, the disease identical with the description of regional ileitis, tuberculous cœcum and similar chronic abdominal disease in the south and west of India is due to the following :—

(1) Faulty modes of dieting, often of religious origin, predisposing to chronic infection of the appendix and the sequence of misfortunes that follow.

(2) The prevalence of venereal disease, which gives rise to the same sequences of disease as the appendix, also lymphogranuloma gives rise to intestinal obstruction of the type described as regional ileitis.

(3) That working bare-footed in paddy-fields and walking on infected ground will also set up the same intra-abdominal naked-eye pathology as that consequent in chronic appendicitis, the only difference being that entry is from the inguinal or femoral canals.

(4) That the vague disease sarcoidosis may possibly also be a late manifestation of lymphogranuloma.

It is therefore necessary that each patient be viewed in association with his habits and environment, the result of chronic low-grade infection *plus* time be given due consideration, and the possible value of Fouadin or its substitutes be kept in mind.

I hope in due course to lay some pathological evidence on the table to support these clinical observations, but the life of a district officer is too full and varied for that attention to detail so necessary before arrival at any conclusion. In the rush of life records are apt to be few, while mental impressions are apt to be fallacious.

However, others may be in a position to confirm, refute or follow up some of the above suggestions, and once the extreme prevalence of lymphogranuloma becomes appreciated, perhaps some of the Indian manufacturing

(Concluded on opposite page)

## A TRANSFUSION SET FOR USE IN HOSPITALS OR IN THE FIELD

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SANT RAM DHALL, M.B., M.S.  
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and

SISTERS P. BAMFORD and V. K. RAO  
(From The Lady Willingdon Hospital, Lahore)

Blood, plasma and serum transfusions are now universally accepted as being an essential part in the treatment of hæmorrhage, shock, burns and a number of chronic diseases. What is not so well known or appreciated is that, in an acute condition, the best results are obtained by the early transfusion of the appropriate substance. It is at present impossible, and beyond the scope of this article to lay down the exact time at which a transfusion should be given. Allowing that there are other essential and routine methods of treatment which must be employed, our own experience is that we are constantly regretting delay.

Providing reasonable care is taken, there should be no mortality resulting from a transfusion. On the other hand, we have seen many patients die that would in our opinion have been saved if we had not delayed.

We visualize the time when in certain cases transfusions of the appropriate substance will be given almost as a routine and to prevent, not treat, shock and other conditions, and would plead for their wider and earlier use in this country.

In order to provide for prompt transfusions, it is necessary to have a complete set of apparatus ready for immediate use. Transfusion substances should also be ready or within easy reach. This article is concerned only with the description and use of a transfusion set which can be used for any substance, and fulfils the following conditions :—

- (1) Portability.
- (2) To be ready for immediate use.
- (3) Be capable of being used under any conditions.
- (4) Conform to the special conditions required by the Army on active service.
- (5) To provide for transfusions, using one or more bottles of one or different solutions.

In the set described, in order to provide for Army requirements the number of spares may be considered excessive for a civil hospital. We would, however, point out that our experience shows there is no harm in having an adequate supply of spares, and it is imperative that the set should be looked after by a responsible person and kept under lock and key until required,

(Continued from previous page)

chemists will endeavour to produce a cheap substitute for Fouadin or Fantorin in response to demand, for these two drugs are of immense value in this part of India, but expensive and difficult to obtain, especially in time of war.

otherwise various items of the equipment are certain to disappear.

The set is contained in tow boxes, an upper metal one designed as a water sterilizer, and a lower wooden one, containing items not requiring sterilization, and spares.

### Contents of upper box (metal)

This box contains all the items required for a single or double bottle transfusion.

(1) Metal transfusion can fitted with lid (for use as a bowl, or small sterilizer), filter funnel, and hanging hooks. The can is for use in case the simple method of transfusion is desired, or in the event of blood clotting in the bottle.

(2) Bottle fitted with blood-withdrawing cork and tubing, and containing blood-withdrawing component (rubber tubing 10 inches with glass window, metal adaptor and intravenous needle). A piece of thread is tied to one end of the component, the other end hangs outside the bottle, providing for easy withdrawal. The bottle, wrapped in a towel with the ends well projecting to prevent trauma to the glass, is placed in the metal transfusion can and covered by the lid. If space is available, the filter funnel is placed inside the can, otherwise elsewhere in the box.

(3) Bottle fitted with blood-giving cork and tubing and metal hanging cage wrapped in a towel.

(4) Blood-giving component, single bottle (figure 1) consisting of—

- (a) Drop regulator;
- (b) Rubber tubing 3/16 inch and two glass connections;
- (c) Intravenous needle and metal adaptor;
- (d) Pinch cocks 2;
- (e) Monel metal gauze filter.

(5) Double bottle component (figure 2) consisting of—

- (a) Metal Y piece;
- (b) Rubber tubing, 2 pieces;
- (c) Pinch cock, one.

Both components are wrapped in a towel.

(6) Glass filter—for use with wool or beads. A spare drop regulator is provided for this purpose and, if required, is inserted above the drop regulator in use.

(7) Set of instruments in bag consisting of—

- |   |    |    |
|---|----|----|
| (a) Sharp pointed scissors 5 inches                         | .. | 1  |
| (b) Dissecting forceps                                      | .. | 1  |
| (c) Mosquito forceps  | .. | 2  |
| (d) Aneurysm needle   | .. | 1  |
| (e) Blunt hooks   | .. | 2  |
| (f) Scalpel 1½ inches                                       | .. | 1  |
| (g) Infusion cannula  | .. | 1  |
| (h) Half circle cutting needles no. 12                      | .. | 2  |
| (i) Linen thread—thin, or any suture material desired, feet | .. | 20 |

(8) Blood matching set in bag consisting of—

- |                                 |    |   |
|---------------------------------|----|---|
| (a) Microscope slides           | .. | 4 |
| (b) Test-tubes 2 × ½ inch       | .. | 2 |
| (c) Hypodermic syringe, 2 c.cm. | .. | 1 |
| (d) Hypodermic needles          | .. | 2 |

### Contents of lower box (wooden)

(Containing items permanently sterile or not requiring sterilization)

- |  |    |    |
|--|----|----|
| 1. Sodium citrate, 4 per cent, ampoules of 80 c.cm.                          | .. | 8  |
| 2. Sodium citrate tablets, gm. 1, packets of 12                              | .. | 12 |
| 3. Bandages, loose-weave uncompressed, 2½ inches × 6 yards                   | .. | 4  |
| 4. Wool, 2-oz. packets   | .. | 2  |
| 5. Gauze—surgical, loose-weave—unmedicated, 25 inches wide × 3 yards, packet | .. | 1  |
| 6. Ampoules procain, 2 per cent, 1 c.cm.                                     | .. | 6  |
| 7. Knife, glass cutting  | .. | 1  |
| 8. Tape—narrow, yards  | .. | 18 |



9. Linen thread—thin—or any suture material desired. 50 feet .. 1
10. Methylated spirit, ounces .. 4
11. Syringe enema, fitted with 3 inches rubber tubing at valve end, for use as vacuum producer .. 1
12. Adhesive plaster 3 inches × 10 yards .. 1
13. Rubber tubing 5/16 inch for tourniquet .. 1

#### Spare

- (1) Drop regulator—complete .. 1
- (2) Drop regulator spare cork and glass connection .. 1
- (3) Glass beads 1½ ounces .. 3
- (4) Adaptor for wide mount needle .. 1
- (5) Needles, blood-withdrawing and giving .. 2
- (6) Needles, blood-withdrawing adaptors .. 2
- (7) Pinch cocks .. 2
- (8) Needles, hypodermic .. 2
- (9) Needles, cutting half circle no. 12 .. 2
- (10) Test-tube 2 × ½ inch .. 1
- (11) Rubber drainage tubing 3/16 inch, feet .. 5
- (12) Glass tubing 9 inches, pieces .. 10
- (13) Corks, rubber for blood-containing bottle 2

#### Vein seeker

This is not provided but can be improvised out of the items in the set (see figure 3).

*Care of apparatus.*—The care of the apparatus should be in the hands of a responsible

person. It is important that each item of the apparatus should be kept scrupulously clean. There is ample evidence to show that a higher incidence of reactions results from unclean than from clean apparatus. All new glassware should be boiled in soapy water for 15 minutes, washed in tap water and immersed in the following mixture for 24 hours:—Potassium dichromate (commercial) 100 gm., sulphuric acid concentrated (commercial) 250 c.cm., water 750 c.cm. Then wash thoroughly in tap water until water is neutral to litmus; finally wash in distilled water. If the above is not available, commercial nitric acid can be substituted. Following blood and plasma transfusion, glass and rubber becomes coated with albuminous material

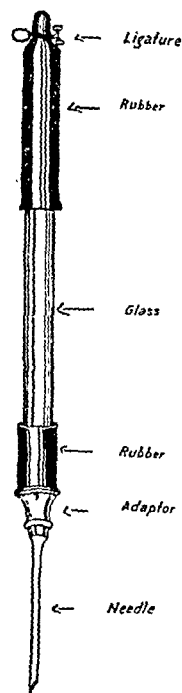


Fig. 3.—Vein seeker.

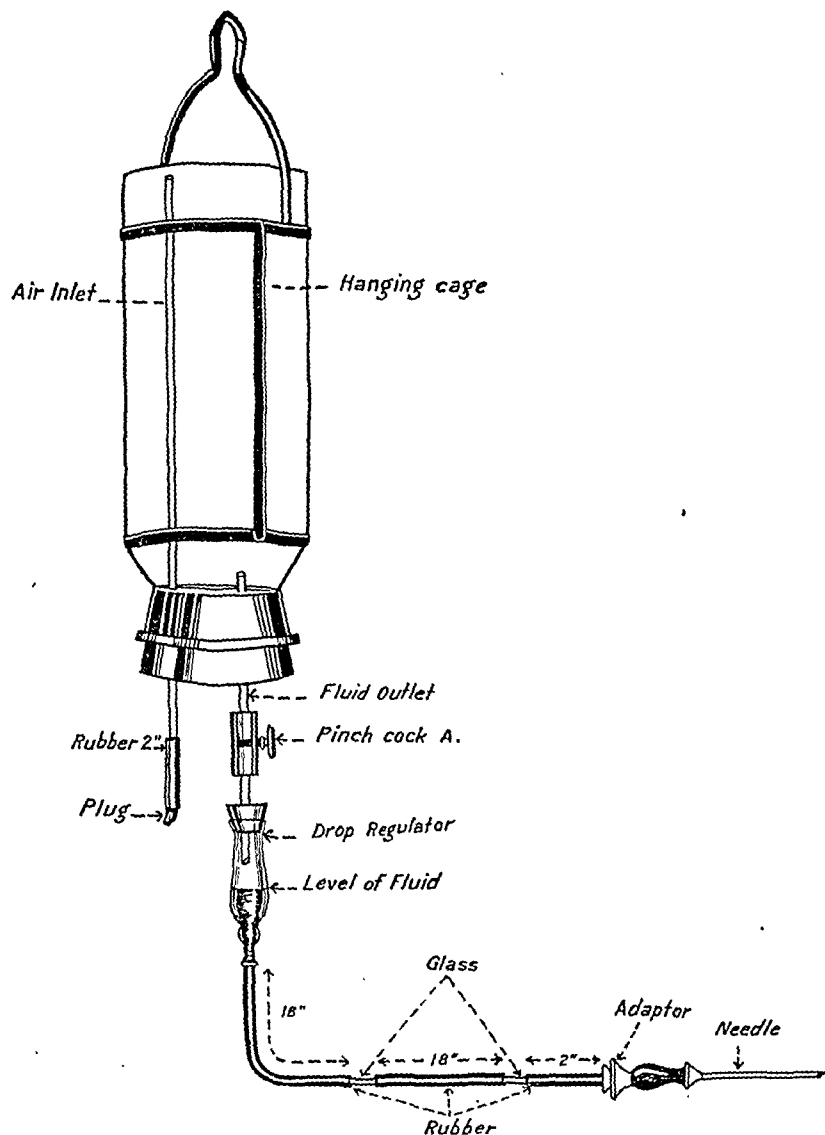


Fig. 1.—Giving bottle and component.

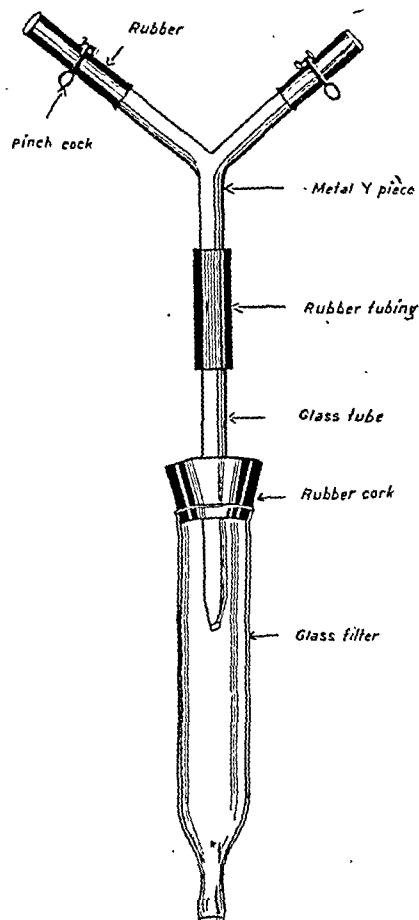


Fig. 2.—Two-bottle component with filter.

which should be removed. Immediately the transfusion is completed, the apparatus should be taken to pieces and thoroughly rinsed both inside and outside in cold water. (Hot water coagulates the protein and forms a deposit difficult to remove.)

If possible, complete the cleaning by passing tape through each tube—under running water. If this cannot be done immediately, soak in cold water and clean later. Water and friction are necessary. Rinsing without friction is useless.

It is better after the preliminary rinsing to boil all glassware and rubber in 0.1 per cent NaOH for half an hour and rinse in distilled water. This removes all debris, clots and plasma. Particular attention should be paid to the bores of needles and cannulae. Wash through with cold water using a syringe, and boil frequently in 0.1 per cent NaOH followed by distilled water. Oil the stilettes with liquid paraffin before inserting in the bore.

*N.B.*—After cleaning and before re-using, each piece of apparatus should be rinsed in distilled water.

#### Assembling apparatus

Assemble the items according to the details given under contents of box A. Note that rubber tubing should be moistened before insertion on to glass, and, as it is apt to stick to glass, fit loosely when assembling and tighten before use.

#### Sterilization of apparatus

Rubber perishes with repeated sterilization in a high-pressure sterilizer. It is advisable when possible to boil rubber articles in distilled water and fit to the apparatus under aseptic condition. All other articles are sterilized in a high-pressure sterilizer.

The box lid is then fastened with adhesive plaster.

#### Instruction for use

*A. Blood matching.*—Even when typed serum is used for grouping donors and patient, direct matching is advisable. The latter will be the only method available in the field. The equipment for blood matching is contained in a small bag in the upper metal box.

*Method.*—Withdraw 2 c.cm of patient's blood, place in a small test-tube and allow serum to separate.

Place 2 drops of serum on a glass slide and add one drop of donor's blood. Mix and rock

gently. If agglutination occurs, the donor's blood is incompatible and a fresh donor should be tested.

*Note.*—Do not allow more than 2 minutes for the test. If the mixture dries within that time, repeat the test using 3 drops of serum and 2 of blood.

*B. Blood withdrawal.*—See figure 4 for details. The donor should lie down with his arm supported. Place the receiving bottle below the level of the arm, to assist the flow of blood. Remove withdrawing bottle from metal can and spread sterile towel under the arm. Prepare citrate solution in can lid (2 tablets to 100 c.cm. distilled water). Remove blood-withdrawing component from bottle and place in citrate solution. (Fill the rubber tube with the solution and hold up by the end until solution drips from needle); this will obviate clotting. Add 80 c.cm.

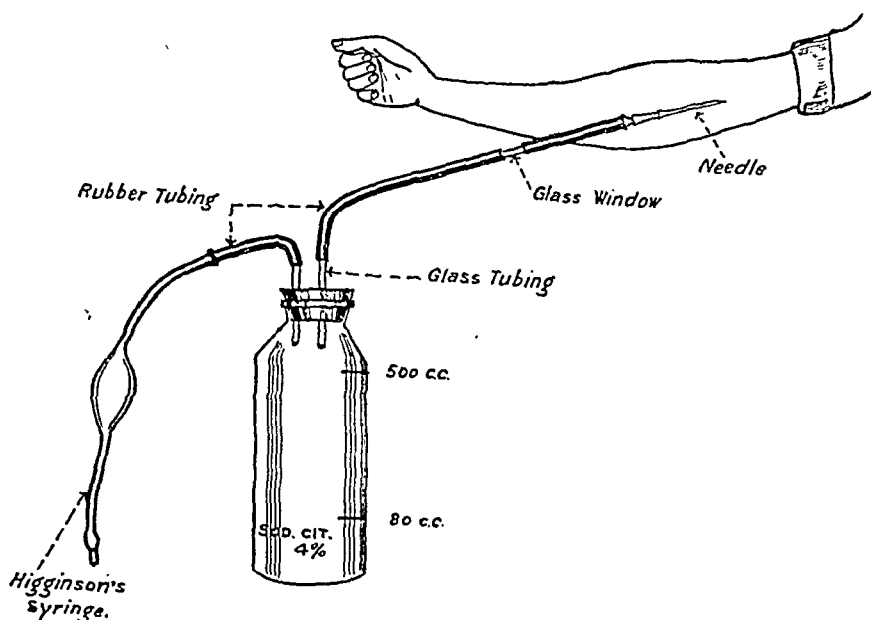


Fig. 4.—Blood withdrawing.

of 4 per cent citrate (ampoule in lower box) to bottle. Cork and rotate bottle on its side to coat the inside with citrate.

Apply tourniquet of soft rubber—or syhygmanometer cuff (inflated to 80 mm. Hg.) to donor's upper arm. Clean skin area in bend of elbow with spirit. Instruct donor to open and close his hand several times. Attach blood-withdrawing component to bottle. Select suitable vein and insert needle. As blood flows, gently rotate the bottle to mix blood with citrate.

If flow slows down—attach Higginson's syringe by its reversed end to the bottle and pump gently to create a vacuum.

When sufficient blood has been withdrawn (maximum 500 c.cm.), remove tourniquet and needle—apply gauze and bandage to the arm. Give the donor a hot drink and allow him to rest

for 15 minutes. He can then resume his ordinary occupation.

*C. Blood giving.*—(See figure 1).—The blood-withdrawing cork should now be replaced by the blood-giving cork and the hanging cage attached to the bottle. The blood-giving component with the upper pinch cock closed is attached to the fluid outlet tube and the bottle inverted and suspended by the hanging cage. (As rubber corks are liable to fall out, it is advisable to tie a piece of tape to the bars of the hanging cage and across the cork.) Evacuate the air from the part of the component below the drop regulator as follows.—Hold the needle in such a manner that the rubber tubing forms a U. Remove air inlet plug and open the pinch cock 'A'. Move the needle and tubing up and down until all air is expelled. Regulate flow by upper pinch cock until it is one drop per second. Close lower pinch cock.

During this time an assistant should be dis-tending the patient's vein by applying the tourniquet. The needle is then inserted into a suitable vein and strapped to the limb by adhesive plaster.

If the veins are too collapsed for a needle to be used, a vein in the arm or leg is exposed and the intravenous cannula inserted and strapped to the limb by the tape.

*Drop regulator—rate of flow.*—The average rate of flow suggested is :—

Severe hæmorrhage cases—500 c.cm. in 30 minutes. Later 40 drops per minute.

Moderate hæmorrhage cases—500 c.cm. in 45 minutes. Later 40 drops per minute.

Slight hæmorrhage cases—500 c.cm. in 1 hour. Later 40 drops per minute.

Shock hæmorrhage cases—500 c.cm. in 45 minutes. Later 40 drops per minute.

The safest rate is 40 drops per minute as with it reactions are fewer, the transfusion fluid need not be warmed, and, when the myocardium is affected, danger is minimized.

Keep the level of fluid to that shown in drop regulator (figure 1). The level can be adjusted by loosening the cork of the regulator to allow air to enter. To prevent the cork from falling out, apply a strip of adhesive plaster around the cork and the upper portion of the regulator.

*Fitting glass tubing to corks.*—Glass tubing at present available is somewhat brittle and breaks easily. To avoid cut fingers, great care should be used. When inserting glass tubing into rubber corks—thoroughly wet the cork and the tubing. Smearing with soap is also useful. Insert the tubing as far as possible with the fingers, then place it on a hard object, such as a table, holding the cork with both hands, and press through the cork as far as is desired. Tubing can be removed by holding the cork with one hand, pulling and turning the tubing with the other, and at the same time pressing the other end of the tubing against a hard object.

(Concluded at foot of next column)

## PLASTER OF PARIS

By F. V. STONHAM

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PLASTER OF PARIS is manufactured from gypsum by calcining it at a moderate temperature. Pure gypsum is a white crystalline mineral which consists of hydrated calcium sulphate  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ . On heating it to a temperature ranging from  $107^\circ\text{C}$ . to  $130^\circ\text{C}$ ., it loses water and is converted into plaster of Paris  $(\text{CaSO}_4)_2\text{H}_2\text{O}$ . Excessive heat converts it into anhydrous calcium sulphate  $\text{CaSO}_4$  which takes up water very slowly and does not harden and set.  $2\text{CaSO}_4 \cdot 2\text{H}_2\text{O} = (\text{CaSO}_4)_2\text{H}_2\text{O} + 3\text{H}_2\text{O}$ .  $(\text{CaSO}_4)_2\text{H}_2\text{O} = 2\text{CaSO}_4 \cdot \text{H}_2\text{O}$ . Commercial plaster of Paris is manufactured from impure gypsum and therefore contains the impurities present in the gypsum such as alumina, iron, silicates, carbonates, lime, etc., which can be recognized by appropriate chemical tests. These, together with traces of undehydrated gypsum, or anhydrous calcium sulphate, do not interfere with the proper setting unless they are present in excessive amounts. Traces of gypsum, in fact, accelerate setting.

The same effect can be observed when plaster bandages are soaked in water which has been contaminated by having been used to wet previous bandages and has become milky with plaster. (Calcium sulphate is soluble in water, 1 part in 372 at  $26^\circ\text{C}$ .) Various grades of plaster on the market possess different rates of setting. Admixtures of alum, or borax, retard setting, while common salt and sodium phosphate accelerate it. We have not found, however, that the practice of adding these substances to the water used to wet the bandages serves any useful purpose when the plaster is of poor quality and lacks setting properties. Neither does the previous roasting of tins of defective plaster cause any appreciable improvement of setting properties as can be understood from the chemical considerations already alluded to.

There appears to be much defective plaster of Paris on the market at present and those grades which set very slowly or become powdery and crumbling after the mould has set are of no use for surgical purposes. Good surgical plaster of Paris should set quickly and hard under all conditions of temperature and humidity and should remain hard permanently. It should be of fine texture and free from grit. Any samples which are not pure white in colour should be regarded with suspicion. The conversion of gypsum into plaster of Paris is an endothermic

(Continued from previous column)

The boxes and infusion can contained in a teakwood box can be obtained from Raghunath Rai and Sons, Ravi Road, Lahore. All other components can be obtained locally and fitted up with the aid of the diagrams.

reaction, and heat is given off when the plaster is again wetted. Heat is also given off if the sample is adulterated with lime. Surgical

produced slabs which sagged or bent into a curve when similarly held. The results of these experiments are given in table I.

TABLE I

Serial number	Plaster used, sample number	Origin	Cloth used	Evidence of setting	Rigidity	Remarks	Culture	Whether found satisfactory in actual use
1	1	Indian	Thick muslin.	None. Soft after 15 minutes.	Did not become rigid.	Remained permanently soft and crumbling. Colour greyish.	Non-pathogenic spore forming bacilli.	No.
2	1	"	Surgical gauze.	Some setting in 10 minutes.	Remained soft for 30 minutes.	Pseudo-setting in dry weather, became crumbling and powdery later.	"	"
3	1	"	Crinoline Surgical gauze.	Did not set	Did not become rigid.	Plaster "yellowish and gritty.	"	"
4	2	"	Crinoline Surgical gauze.	Did not set	Did not become rigid.	Plaster "yellowish and gritty.	"	"
5	2	Indian packed.	Crinoline Surgical gauze.	Set in 1" minute	Hard in 13 minutes.	Remained hard and rigid several weeks.	"	Yes.
6	3		Crinoline Surgical gauze.	Set in 1" minute	Hard in 13 minutes.	Remained hard and rigid several weeks.	"	"
7	3		Thick muslin.	Set in 4 minutes	Hard in 10 minutes.	"	"	"
8	3	"	Crinoline	Set in 2 minutes	Hard in 12 minutes.	"	"	"
9	4	English	Thick muslin.	Set at once	Hard in 4 minutes.	"	"	"
10	4	"	Surgical gauze.	"	"	"	"	"
11	4	"	Cheese cloth.	"	"	"	"	"

plaster of Paris is sold in a variety of packings, but that preferred is the moderate-sized square tin which is easily stored and packed for transport.

We have recently received certain brands of plaster which have proved unsatisfactory in that they have failed to set properly and had a tendency to crumble afterwards. Some samples did not set at all and casts prepared from them remained in a wet partially-set condition for several days during wet weather. In hot dry weather only pseudo-setting took place—the plaster merely dried as mud dries.

Samples of various grades were subjected to the following test. Bandages were carefully prepared to eliminate any possibility of uneven incorporation of the powder and were carefully and thoroughly soaked without agitation. When quite sloppy they were rolled into a slab about 20 inches long, and each layer was carefully smoothed down as the bandage was unrolled. When complete, one-third of the slab was folded over and pressed down, and the whole allowed to dry. This produced a short slab half of which was 20 layers thick and the remainder 10 layers. With good plaster the slab in a few minutes became rigid enough to enable it to be held in the hand by the thin end, as a rigid board. Those specimens of plaster which had been found unsatisfactory in actual use

Plaster of Paris is rolled into bandages by smearing the dry powder over the cloth with the hand and rolling up from the opposite end. The powder should be evenly and smoothly incorporated and the correct amount can only be learned by experience, since it varies slightly according to the cloth used. If the completed bandage is rolled too tightly it takes a long time for water to soak in and properly wet it, and if rolled too loosely the centre slips out of the bandage as it is being applied. If the proportion of plaster to cloth is too high a brittle cast results, and if too little the resulting cast is soft and tends to disintegrate rapidly. Various cloths are in vogue. If the cloth is too heavy and of too fine mesh it lacks docility and it is difficult accurately to apply it round prominences like the ankle. Moreover, with fine-meshed cloth the bandage must be prepared with meticulous care because the wet plaster cannot so easily come through the interstices as the bandage is wound on, compensating for any unevenness. Bandages prepared with fine-meshed cloth are much more difficult to wet evenly and quickly. If the cloth is too open in texture, much of the plaster escapes into the bucket from the outer layers of the rolled bandage when it is immersed in water.

The cloths available in India comprise crinoline (put up for Government use in

compressed form, three inches by six yards); ordinary surgical gauze, muslin, *pagri* cloth, and 'book' muslin. Excess of starch in the cloth interferes with proper setting. We find there is little to choose between any of them, but we dislike muslin which is too closely woven or too heavy. Sackcloth is occasionally useful in the preparation of very heavy casts such as plaster beds and spinal jackets.

It seems customary to use bandages six yards long and six or eight inches in width. In the fracture department of the British General Hospital, Poona, we prefer the five-inch width as the most generally useful, especially for moulding round the foot and ankle in the case of thin legs, and about five yards long to facilitate cutting, because we use principally surgical gauze which is provided in bulk in sixteen-yard rolls. The compressed crinoline is mainly used for the forearm since the narrowness of the bandages provided render them of limited value for lower limb casts. To obviate the nuisance of the centre falling out of these bandages each is unrolled and cut into two before incorporating the plaster to make them of convenient size.

The correct wetting of a bandage is a point of importance. The bandages should be placed in a fairly deep vessel such as a bucket, by gently immersing them end on and leaving them until no more bubbles of air appear. They are then ready for use and should not be wrung out at all. Within limits, the more sloppy the bandage is when applied, the harder and more durable will be the resulting cast. The water should not be more than two inches deeper than the width of the bandage, because deeper immersion causes the bubbles of air to agitate the water with resulting loss of plaster from the exterior layers. It is neither necessary nor desirable to use hot water. When the plaster cast has been completed its appearance and durability may be enhanced by polishing it with wet hands, and if necessary by smearing on a little freshly-made plaster cream to obliterate any ridges and depressions which might be potential sites of cleavage. Definitely weak spots should, however, be reinforced by means of an extra bandage.

Modern plaster technique aims at making the mould as light as possible consistent with strength and the avoidance of padding. Padding tends to reduce the immobilizing effect and also renders removal by any method other than cutting through it with a knife or saw more difficult and tedious. There has been a tendency for 'plaster technique' to become extremely complicated and develop almost into a speciality. We find that the custom of employing a multiplicity of slabs and cut-up pieces of slab as 'strengthening bands' to be of little use, since, unless applied with meticulous care, this makes the casts actually weaker. Practically all the casts consist of a simple single slab and circular bandage, and these are perfectly satisfactory and consume less time. The

methods used in the arm, leg and spine plasters will be described in detail.

### *The forearm plaster*

Two suitable bandages are selected and soaked. One bandage is rolled out into a flat slab of suitable length on a table or bench. It is convenient to have the edge of the table marked with saw cuts to indicate the average lengths required. The arm has of course already been prepared by reduction of any fracture, or appropriate treatment of any wound. The slab is placed along the dorsum of the forearm and should extend from just below the knuckles to the elbow. The proximal end is suitably folded over in an oblique manner to clear the bend of the elbow. Commencing at the wrist the circular bandage is then applied and worked up the arm to the elbow and back over the dorsum and palm of the hand, encircling only the base of the thumb. The bandage should not cross the palm more distally than the proximal crease. If it does it can be pushed down while still soft and the patient instructed to clench his fist and flex his elbow. The cast is then accurately moulded and allowed to dry. In applying the circular bandage there should be no folds or ridges to irritate the skin, and any tucks required to facilitate even application of the bandage should be made where the bandage crosses the slab. Any edges of the mould likely to irritate the hand or the base of the thumb can if necessary be smoothed or cut away later.

If the plaster is to be carried up to the axilla either a second slab is applied to the lateral or dorsal aspect of the upper arm, or a U-shaped slab is applied, and a circular bandage completes the cast.

A very small pad of wool is placed over the bend of the elbow to prevent circulatory interference and to facilitate removal. We do not pad the olecranon and have no trouble. To prepare an arm spica, a second slab passes from the elbow, along the inner side of the arm to the axilla and down the side of the chest to the iliac crest where it is padded with wool or sponge rubber. The spica is completed with circular bandages passing round the arm and around the shoulder and chest and under the opposite axilla. The spica should be supported until it has thoroughly set and then reinforced by means of a piece of metal or Cramer wire previously bent to a suitable shape.

The same forearm plaster can be modified for fractures of the metacarpals, phalanges, etc., by incorporating suitable wires, and, if necessary, by placing the slab along the volar aspect instead of the dorsal. Dorsiflexion of the hand is seldom indicated.

### *Common errors in arm plaster*

1. The cast extends distal to the proximal crease of the palm, and finger movement is impeded.

2. The cast includes the fingers. This is rarely indicated even if there is paralysis. In the case of fractures or wounds, only the injured finger should be fixed.

3. The cast impedes elbow movement. A U-shaped slab from the forearm around the elbow gives no additional immobility, but it causes a stiff elbow.

4. Reinforcing an arm spica with metal before it sets causes pressure sores. We have seen several of these.

5. Insufficient bandage around the proximal forearm results in early breakage of the cast since this part is easily damaged when the patient rests his arm on the table or on his knees.

6. Failure to mould the plaster accurately around the palm where the bandage tends to be thrown into folds results in loss of immobility. Insufficiently wet bandages are also responsible for this defect which permits the hand to move slightly at the wrist.

7. The incorporation of wooden 'pencils' with the object of separating the forearm bones is apt to cause muscle weakness and pressure sores. It is doubtful if this manoeuvre is of any real value. Pressure on the pronator teres is just as likely to approximate the bones.

#### *Leg plasters*

A five-inch slab is rolled out equal to the length of the leg *plus* double that of the foot. The slab is then folded to make the sole-piece of double thickness and nicked with scissors opposite the heel. The slab is then accurately moulded to the leg and foot. The sole-piece, where nicked, is moulded over the remainder of the slab superficially. The cast is completed with one or more circular bandages. If the plaster is to go above the knee we first complete the leg and then apply a second slab and complete the thigh portion. The patella is padded with a little wool for comfort and to facilitate removal, since when cutting down it can be pulled out when the patella is reached. With the patient suitably supported, extra slabs, padding over bony prominences, and extra circular bandages, convert the cast into a spica.

For closed plaster treatment of wounds two five yard five-inch bandages suffice, but for fractures and walking casts extra bandages are required according to the build and physical development of the patient. It is sometimes of advantage to fit a U-shaped slab passing down one side of the leg, across the heel and up the other side to strengthen the cast laterally, especially when the plaster is to be relied upon to prevent redisplacement of bony fragments, and also when Steinmann's pins are employed, in which case the slab is cut to receive them.

#### *Common defects in leg plaster*

1. The sole-piece projects unduly. This catches in objects when the patient is walking, in the bedcloths, etc., in addition to being likely

to break. It should be trimmed off immediately distal to the toes.

2. The sole-piece is too thin and it soon breaks. This can be prevented by increasing the thickness of the dorsal slab or by making the sole-piece of double thickness as described.

3. Foot drop is very common and indicates perfunctory application or lack of assistance. In the latter event the plaster can be applied with the patient sitting on a table with the foot resting on the seated operator's knee.

4. Excessive inversion is the result of well-meaning attempts to prevent flat foot. It results in claw foot.

5. Walking casts which are too flimsy to be durable are commonly seen, and occasionally unduly massive casts are encountered which not only impede walking but are very laborious to remove.

6. Too short casts are very common. If a fracture is in the upper two-thirds of the leg the plaster should certainly extend to the groin. Plaster 'shoes' for fractures in the foot are uncomfortable and are not recommended. It is better to continue the cast almost up to the knee, and not bother about the theoretical disadvantages of immobilizing the ankle.

#### *Walking irons*

The Böhler type which is curved on the tread results in a tendency for the patient to rotate his leg on it when walking. This results in torsion of the fragments and delayed union. It also prejudices the maintenance of proper muscle tone, and irons with a flat tread are preferable though they do not entirely solve this difficulty. Those with a flat wide rubber base are better still. We can make inexpensive and satisfactory iron in a few seconds by bending a piece of mild steel bar in a vice. If accurate contact with the ground is not secured the iron is bent with Lane's plate benders. It is conventional to fix the iron so that it projects two or three finger-breadths beyond the heel. In cases when already developed foot drop cannot be corrected completely and where the patient is likely to walk anywhere but on a hard surface, we find it expedient to allow almost double this amount of clearance.

#### *Spinal jackets*

The patient is placed in the position advocated by Watson-Jones either by means of two suitable tables, or by means of a table and pulley with sling. With the latter method it is easier to get at the patient. A cotton vest is applied, or else a piece of lint is placed over the back and nicked with scissors at suitable places round the edges to mould it to the contour of the body without folds. Two large scissor-cuts are required opposite the concavity of the lumbar curve. Padding by wool or sponge rubber is needed over the anterior superior iliac spines. The pubic hair is protected by a piece of jaconet. The sternum, if necessary, can be padded after



the cast is complete. We do not find it necessary to pad elsewhere. It is important to observe that the aim of a spinal jacket is to immobilize by a three-point suspension.

Injuries and diseases commonly occur in the dorso-lumbar region where the plaster should accurately fit. The plaster prevents any tendency for the already fully-extended spine to extend further by its contact, while any flexion is prevented by contact with the sternum and pubis. Hence it should be carefully applied to impinge on these two bones.

The jacket is commenced with circular bandages, reinforced with slabs, and completed with more circular bandages. Slabs of suitable size can be prepared dry and *folded*, not rolled. They merely require wetting and unfolding prior to application. Slabs are placed on either side of the spine, along the sides of the body, and one is placed over the sternum. Pieces of sackcloth thoroughly impregnated with *fresh* plaster cream can be used instead of slabs. The plaster over the abdomen can be left fairly thin, and some cut away when the plaster is completed. A small pad of wool may be placed over the umbilicus, before the jacket is started, to facilitate cutting. The window should not be large, and in fact some authorities are opposed to making any window at all. However, it definitely does add to the patient's comfort in breathing, and dispenses with some unnecessary weight. It is advisable to reinforce rather heavily the upper and lower ends of the jacket with bandages, paying special attention to the pubic and sternal regions. It is usually necessary to trim the plaster in the axillary and inguinal regions to allow unimpeded movement of the arms and sufficient flexion of the thighs. Plaster beds are made in much the same way, but it is an advantage freely to employ plaster-soaked sackcloth. It is advisable to make them much heavier and of more even thickness. The bed should extend a little more than half way round the body. It is then removed and allowed to dry in the sun and is trimmed with a saw and the edges bound with adhesive plaster, subsequently.

#### *Common defects in plaster jackets*

1. The jacket is too short and does not fix the sternum and pubis, and considerable mobility of the spine is permitted.
2. The jacket is too flimsy and does not survive the rather long period—often many months—for which spinal jackets are usually needed.
3. The aperture cut over the abdomen is too large and too wide and this causes the sides of the jacket to break or buckle.
4. Insufficiently wet bandages are used, or stale cream cut of the bucket is smeared on, and the result is dehiscence of the layers.

#### *The closed plaster treatment of wounds*

Advocates of this method advise against too early removal of plaster casts. It is found,

however, that a tendency exists for this to be interpreted too literally. When the cast becomes soaked with pus, and highly offensive not only does it soften and fail to perform the function for which it was fitted, but it results in the patient developing anorexia and neurotic symptoms. The nuisance of the stench to other occupants of the ward cannot be altogether disregarded. Moreover, the outside of the cast becomes infectious and I am of the opinion that pyocyaneus and other infections can be conveyed from the exterior of these casts to other patients by flies. When used for injuries to the soft parts and the wounds have granulated they often heal rapidly when the plaster is discarded and the wounds are suitably dressed. It is ridiculous to assume that pus can be completely innocuous when it is seen to be capable of excoriating healthy skin.

The value of the closed method of wound treatment is beyond dispute, but it must be applied intelligently. The closed plaster method must, however, be used with caution in cases where secondary hæmorrhage from a large vessel is to be feared and in cases of deep wounds which are likely to close over. If the patient is likely to be sent on a journey soon after the application of plaster, the cast should be completely split. Wounds should not be packed with dry gauze because it is a powerful foreign-body irritant. The abscess-producing effects of the forgotten swab in the abdomen need no emphasis. We find that wounds which have been packed with plain gauze heal slowly with the production of excess of pus, while those packed with gauze impregnated with vaseline or B.I.P.P. do much better.

#### *The Spanish method*

Tructa (1940) recommends the application of plaster by impregnating a piece of flannel, cut to the size of the part, with plaster cream and bandaging it on. This is a simple and quick method, and the resulting casts are of surprising strength considering their lightness. The difficulty is in making the flannel lie evenly and without ridges and folds. It requires practice. We do however occasionally employ this method, especially for wounds and fractures of the forearm.

Tructa claims that by this method casts can more quickly be applied and removed and that the maintenance of a stock of prepared bandages is unnecessary. It must be admitted that these advantages are very formidable.

#### *Removal of plaster casts*

Contrary to common belief, unpadded casts are not more difficult, but actually easier to remove. There is no padding to obstruct the shears. Padding however affords some protection if a knife or saw is employed. In modern plasters made by means of the slab and circular bandage there is a thin part to cut. The most efficient implement is the ten-inch size Still's

pattern shears. The larger shears are cumbersome and awkward for routine use, though occasionally they are needed to cut very thick parts where the extra leverage is called for.

Cutting with the knife is tedious and commonly results in cuts in the patient's skin, though the use of the knife is difficult to avoid, especially where there is a thick tight band of plaster across the ankle, which defies the insertion of shears. The application of such substances as acetic acid or peroxide of hydrogen with the

brace it is simply twisted through the cast while the key holds the other end. It is not always necessary to include it in the cast to begin with, since a guide can be made from a steel tape measure, one end of which is blunted with a smear of solder and it can be slipped under the plaster after the fashion of a Gigli saw guide and pulled through, drawing the wire attached to the other end with string. The approximate strength of the various wires available is given in table II.

TABLE II

Stainless-steel piano wire	..	{ Gauge .. .. .	0.016	0.018	0.022	0.026	0.030
		{ Breaking strain in pounds ..	50	70	100	150	200
Steel piano wire	..	About 25 per cent stronger.					
Stainless-steel cable wire	..	{ Diameter .. .. .	1/32"	3/66"	3/64"	1/16"	
		{ Strands .. .. .	21	21	49	49	
		{ Breaking strain in pounds ..	110	235	270	480	
Aeroplane cable	..	{ Diameter .. .. .	1/32"	3/64"			
		{ Strands .. .. .	7	19			
		{ Breaking strain in pounds ..	185	400			

object of softening the plaster is futile. The removal of plaster is always laborious and an ordeal to the patient especially if there are open wounds, and this should be foreseen and the plaster should be applied in such a manner that it can be removed as expeditiously as possible.

Various other means have been devised to cut it, such as the incorporation of metal strips to cut down on, or the introduction of Gigli saws under the casts. Neither has proved very satisfactory nor do the power-driven circular saws depicted in certain instrument-makers' catalogues appear to have become popular. A recent development is the incorporation of a piece of wire under the plaster which is simply torn through in the same way as a box of ampoules is opened by tearing a piece of string through the label. The method works best with proprietary bandages which are thinner and harder than ordinary made up bandages, and it does not work well if there is too much cloth in the cast. Galvanized iron wire and piano wire are unreliable. Piano wire can only be depended upon to cut through about 5 mm. of ordinary plaster bandage without breaking. Piano wire must be insulated from moisture by wrapping it in a spiral of greasy paper. Stainless wire can be used but it is not so strong. Aeroplane cable is much better and we have been able to cut strong plasters up to 2 cm. in thickness, though it breaks if it is asked to do any more than this. It is much less likely to snap than solid wire of equal tensile strength.

The tools to use with the wire can be made by any engineer from one-quarter-inch mild steel rod. One key is made like a large sardine tin-opener and the other is shaped as a brace. Each has a small hole to receive the wire and a small flange to prevent it rolling off the end. The aeroplane cable is soldered at the ends to prevent the strands from fraying, and by means of the

### Summary

1. The chemistry and properties of plaster of Paris have been given.
2. The more important points in the preparation of plaster bandages to be observed, have been discussed.
3. Simple yet efficient methods of applying the commoner plaster casts have been given in detail.
4. The commoner faults observed in plaster casts have been enumerated. This has been based upon actual experience in base hospitals (B. G. H., Poona, I. M. H., Poona, I. G. H., Kirkee).

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### PLASTER OF PARIS IN THE TREATMENT OF WOUNDS AND FRACTURES

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THE present war has shown that many war wounds are best treated in plaster of Paris; this medium, unfamiliar to some surgeons, has peculiar advantages and calls for special craftsmanship. It is an attractive medium and much depends on correct technique which is the subject of this paper. When the plaster is in good order a creamy bandage or fabric makes a rigid shell in

a few minutes, passing progressively from almost perfect pliability to rigidity at a rate which conforms favourably with the needs of the surgeons and thus provides the most suitable and perfect splint. With good team work little time is wasted and no movement need be hurried.

A trained plaster-room team of sisters, nurses and orderlies is essential to the smooth running of a long sequence of plasters. In a hospital the best way of initiating and organizing an efficient plaster-room team is to send a carefully chosen sister and orderlies to an orthopaedic hospital for training in the plaster room. Unfortunately, the surgical hospitals in our country seldom give special training in this work.

#### *Material and instruments*

A second need is the provision of the correct materials and instruments and an exact knowledge of their preparation and handling. The first essential is the fracture table, and Hawley's table is one of the most suitable for this work. The instruments commonly used include several Still's plaster cutters, plaster-cutting saws, scissor-like cutters for cutting soft plaster, strong scissors for cutting felt, strong scalpels (second hand from the theatre), a glove stretcher for opening the plasters after cutting, wire cutters, a tape measure, a pint measure, pails, bowls, and a trough or bucket for soaking large fabric plaques.

The materials needed are as follows:—

Plaster of Paris 'superfine' such as supplied by Terry Bros., book muslin, 32 threads to an inch, wool bandages, white felt,  $\frac{1}{4}$  inch thick, white adhesive felt  $\frac{1}{2}$  inch thick backed with zinc oxide, malleable iron wire, 10 to 20 a.w.g., flat strips of malleable iron, 2 feet long,  $\frac{3}{4}$  inch wide,  $\frac{1}{2}$  inch thick, Cramer wire, 3 $\frac{1}{2}$  inches  $\times$  24 inches, 1 inch  $\times$  4 inches, and glacial acetic acid.

We have never come across a case in which infection has been due to the plaster, but it is advisable that bandages should be prepared under conditions as free as possible from risk of contamination by pathogenic organisms.

The white felt is all passed through the autoclave to eliminate any possibility of tetanus from plaster sore. The plaster and plaster bandage should always be kept in air-tight containers wrapped in newspaper in a dry place otherwise they absorb moisture and become useless.

Two distinct methods of applying plaster of Paris are available (1) with previously prepared bandages purchased or home-made and (2) with creamed fabric, a method originally described by Thornicroft and subsequently adopted in various ways most recently by S. Trueta, in which a suitable fabric cut to measure is passed slowly through plaster cream, spread out and rubbed on a board, and then quickly applied to the limb.

#### *Technique of plaster bandage and bandage-plaque method*

*Making of bandages.*—The muslin is supplied in rolls about 1 yard wide and 12 yards long. This is torn into strips of various widths and lengths from 6 inches  $\times$  4 yards to 3 inches  $\times$  2 yards. From each strip of muslin the outer 3 threads on each side are drawn, otherwise

these threads tend to fray and hamper the application of the bandage. The strips are then rolled loosely. The process of changing this muslin strip into a plaster bandage is best learnt by watching and practice. The bandage is unrolled foot by foot and passed through a heap of dry powdered plaster on a smooth board and re-rolled as the plaster bandage. About 12 to 15 inches of the bandage lies exposed on the board at a time, and into it powdered plaster is rubbed (Figure 1). Just the right amount of powder must be rubbed into it and retained in the mesh or left as a very thin even layer on the surface of the muslin as it is rolled up into the bandage. This rolling, too, must be done rather loosely and very evenly. If the bandage is too tight, as is often the case when a novice rolls it, water cannot soak into it; if it is too loose, the powder tends to escape before, during, and after the soaking, and the bandage tends to run out in a 'tail' during its application. The rolling of bandages is indeed a very important part in the technique and is only learnt by experience and watching.

For the limbs, bandages of 6 yards long  $\times$  5 inches wide are preferable whether for adults' or children. Bandages for the pelvis and spine should be wider about (20 cm.) 6 $\frac{1}{2}$  inches. The rolled plaster bandage 5 inches (15 cm.) wide should weigh about 400 gm. and 20 cm. about 500 gm. Plaster bandages made with starched muslin are not so good because they are slow in drying.

*Soaking.*—Everything must be ready beforehand. A likely number of bandages should be set out on a tray; this is advisable because, if bandages are picked out of the stock tin with wet hands, drops of water get on to the other bandages and ruin them. Plenty of warm water should be set out in two deep basins for small plasters or two pails for large ones. A smooth wooden or marble board 36 inches  $\times$  26 inches should be handy for making plaques. When all is ready, the first two bandages are gently lowered into the water, and there is a right and wrong way of soaking a plaster bandage (figure 2). It should be lowered gently to the bottom of the pail in the horizontal position, to avoid unnecessary loss of plaster powder, and left undisturbed at the bottom of the pail until all bubbling has ceased. It is then lifted clear of the water, still in a horizontal position, and gently squeezed by holding it at the two ends and giving it a twist (figure 3). It is very important to keep in mind that the bandage should never be held in the hand and squeezed like a sponge. The squeezing is only meant to drive out the excess of water, and the bandage should still be dripping wet after the excess of water has been driven out. This method avoids any unnecessary loss or disturbance of the plaster powder in the bandages. If the bandage is lowered or lifted in a vertical position or handled carelessly, powder is lost unevenly and the bandage is spoilt. The nurse unrolls 3 inches of the

bandage and hands it to the surgeon in such a way that it comes naturally to application.

#### *Making bandage slabs or plaques*

Each slab varies according to size and length of limb where it is to be applied. An average plaque, say of 30 inches  $\times$  6 inches size, is easily made from a single bandage. Smaller plaques made from smaller bandages are used for the forearm and hand; and to strengthen the plaster covering the back of the pelvis or the thorax broad plaques 2 feet square made from several bandages are used. The plaques are made by running the soaked plaster bandages to and fro on a smooth board; the bandage is run naturally on the board in one direction, then lifted and unrolled by the fingers as it passes back, dropped down, lifted and unrolled and so on. The whole process is immensely quickened if an assistant puts an index finger on each corner of the plaque as the lifting and unrolling of the bandage is carried out.

#### *Application*

Here it is well to remember that the characteristic virtue of the plaster is the combination of great pliability while it is being applied, with rigidity when it is fully set, and that the period between these phases is critical. It is necessary to hold the limb exactly in the desired position before the plaster is applied, and to maintain this position undisturbed during the application of the plaster and till it is set (becomes rigid). If the position is altered after the application of the plaster or even after a part of the thickness of the plaster has been applied, unsuspected internal ridges will result, causing pain, and are liable to produce what are called plaster sores. The comfort and safety of the patient depend on the even smoothness of the inner surface of the plaster and its accurate and comfortable fit around every bony prominence. A plaster that looks fine on the outside may have a sharp ridge inside. Therefore the position of a limb should never be altered during the application of a plaster. If the position is wrong, the plaster must be stripped off and re-applied. The surgeon should never hesitate to re-apply the plaster if he has the least doubt, keeping in mind that the patient is likely to be discharged from hospital soon after the application of the plaster, and will probably return after several weeks, during which time he may develop plaster sores.

We always prefer unpadded plaster splinting. Padded plaster casts should only be used for transport not for treatment, as it is not possible to provide uniform padding with the result that bony fragments become displaced, and plaster sores often develop over prominent bony points. By careful application of unpadded plaster casts, the pressure is exerted evenly over the whole area of the enclosed limb, so that no one point is subjected to injurious skin pressure. Before applying plaster it is very necessary to be sure that effusion of blood

and swelling has subsided and after the plaster is put on, the position of the limb should never be altered or this will cause creases and pressure points. The skin should not be shaved or greased before the plaster is put on. The plaster attaches itself uniformly to hairs and holds more firmly. Pain is not caused by this as the pull on all hairs is uniform and hence not felt. If the skin is greased, the case loses its grip and the plaster is destroyed as well. The removal of the unpadded plaster case is not painful, because the short hairs of the limbs are changed every four or five weeks, and so these will have been shed when the time comes for the removal of plaster.

When the part to be put in plaster is ready in the desired position a plaster slab or plaque is well moulded over the part and kept in position by a plaster bandage. The plaster bandage should not be drawn tight and only lightly applied. This bandage must never be put on in a circular manner round the part, but should always be applied obliquely. In many fractures, such as the lower end of the radius, a dorsal plaque is sufficient. In putting the bandage on, all creases must be carefully avoided, and, in modelling the plaster to fit round the neighbourhood of the joints, pressure should not be made by the finger tips over bony prominences but evenly over the whole surface with the flat of the hand (figure 5). In certain places it becomes necessary to reinforce the plaster by additional plaster slabs or even metal strips, for instance both in front and behind the hip.

*Polishing.*—Some surgeons prefer to polish the outer surface of the plaster with thin plaster cream with a wet hand. If the cream is thickly laid it often cracks during the next few hours as the plaster hardens and sweats. This also entails dipping the hands many times alternately in the cream and in water—in the cream to fetch it and distribute it over the area to be polished, then in water because the polishing can only be done with a freshly wet hand. The best way in our opinion is to rub the plastered area with a thin wet towel or lint all round by a to-and-fro movement of the towel as shown in figure 6. There is always some excess of plaster of Paris on the bandages, and, when they have been properly applied, the to-and-fro movement with a piece of wet lint gives an excellent polish and finish to the plaster. The plaster thus put on is much stronger, and cracks less frequently than when thick cream coatings are applied.

*Patching.*—When, during the service of the plaster, a part requires reinforcement, it is patched with bandages or with bandage plaques, but a patch will not adhere to a dry plaster unless it is pasted on. The process is as follows :—

The part to be patched and an area round are scratched and roughened with a saw or a file, some thinnish plaster cream is rubbed into

the roughened area and bandages or slab is quickly applied before the plaster cream has had time to set.

### *Creamed-fabric method*

The creamed-fabric method has been strongly advocated by Trueta. In this method there is no need for a very large stock of plaster bandages; it takes less time because a skilful assistant, experienced in the method can cut out the fabric, while the surgeon is completing the operation. The cutting of the fabric of the proper size is done on a table, other than the operating or fracture table, the cast sets more quickly and uniformly; the even and known thickness of the shell permits better radiography and a vertical gap exists from the first, saving the delay and difficulty of cutting. This method evidently requires most skilled assistance and is not advisable for a beginner.

To cut out the fabric of a proper size, measurements of the part are taken on the sound side and 10 per cent added to allow for the shrinkage of the fabric when dipped in the water. The proper outlines are then pencilled on the top sheet of the proper layers of the fabric and the pack is cut out. The required number of layers varies with the thickness of the fabric and the size and weight of the part to be splinted. Trueta prefers thick soft flannel-ette with a loose mesh, but we cannot now obtain this fabric, and use standard plaster-muslin. Three sheets of muslin replace one of flannelette; thus, the wrist requires six of muslin or two of flannelette, the legs nine of muslin or three of flannelette, and an arm or hip spica fifteen of muslin or five of flannelette. Big spicas should also be reinforced with buttresses at the axilla or hip.

The proper amount of warm water is put into a shallow basin, then plaster powder is quickly sprinkled over the whole surface of the water until it ceases to be absorbed and lies on the surface (for a leg 2 pints of water and 4 lb. of plaster). The assistant quickly stirs and rubs the mixture into an even cream, then passes the muslin pack slowly through the cream, making sure that it is fully soaked, lifts it up to drain for a few seconds, and finally spreads it out on the table, making sure that the sheets correspond. If flannelette is used the sheets are soaked separately and then assembled before application.

Before the plaster sets, it is moulded to the surface and a thin layer of cream is spread evenly over it. Some turns of bandage may be used to hold it in position. It is important to see that edges of the fabric do not quite meet, or if they do they are turned back to make rounded rims  $\frac{1}{2}$  inch apart. The narrow channel left facilitates any adjustment of the circumferential hold and the ultimate removal of the plaster.

### *Windows and bridges*

Sometimes it is desirable to have access to a wound or to a bony prominence. This can be achieved by leaving the skin or wound unsupported locally and by reinforcing the plaster round this unsupported area by plaques or ropes of plaster, thus making a window. The wound can be dressed through this window as desired. Sometimes large areas of a limb, or even its whole circumference, may have to remain uncovered or be uncovered daily. In such cases the area is bridged over with ropes of plaster or with plaster with a length of malleable iron within it. Plaster with iron strip is easier to apply, but it may be a nuisance when it is desired to enlarge the window because this cannot be cut with a saw to modify the position. It is therefore often better to use plain solid plaster ropes for bridging buttresses; then with a saw and a few plaster bandages the area to be exposed can easily be increased or otherwise altered.

Another method is to complete the plastering all over and then to outline the area of the window with an indelible pencil; the plaster round this area may be strengthened and when the plaster is just set but not rigid the outline of the window is incised with a sharp scalpel right down to the dressing or padding exposing the wound.

### *Traction or skeletal fixation*

A combination of plaster and traction is sometimes invaluable. Plaster control of the proximal part provides a solid basis for an extension bow, which may vary from the whole length of a Thomas splint to a small loop of wire providing traction for a finger. So, too, can plaster provide a rigid hold for Steinmann pins or for Kirschner wire.

### *Special plasters*

*Arm abduction.*—This should always take a broad padded bearing on the crest of the ilium. The angle of abduction varies with the indications, but flexion and rotation are such that the hand would reach the mouth if the elbow could be flexed. This is important when parts of the humerus have been shot away or removed; for, if ankylosis of the shoulder takes place, a standard position of the arm would cause the hand to be carried past the mouth. The ulnar border of the hand should be supported; otherwise the hand will droop over the edge of the plaster. In most cases the hand is also maintained in slight dorsiflexion by a short extension of plaster into the palm, giving the effect of a short cock-up.

*Lower limb.*—When the whole limb is included in the spica the plaster over the dorsum of the foot should be cut out almost completely, and the plaster should always extend beyond the toes on the plantar surface, holding the toes in dorsiflexion at the metatarso-phalangeal joints and with their inter-phalangeal joints

straight. With this adequate plantar extension of the plaster, wool can be inserted from time to time under the tips of the toes, and steps taken to make sure that the correct position is maintained. The importance of this is great otherwise there will be stiffness of the ankle or the foot, for then hallux rigidus is most painful and crippling.

The plaster is thickly applied where the strain is great. This saves plaster and labour in putting on and even more in taking off the splint. But nurses cannot have it drilled into them too often that they must not lift the plaster by the lower end.

*Hip spica.*—The spica is applied on a fracture table with a fairly small pelvic support. Whenever possible the patient should be lifted from the supine position on the table to a prone position on a layer of pillows on his bed. In any case the back of the plaster must be looked over and any unevenness left by the support corrected. Fingers are passed as far as possible between plaster and skin, to make sure of an even, deep surface, and sufficient plaster is removed in the form of a narrowish inverted U to allow of clean nursing. While the patient is in this position, one should make sure that plaster is of adequate strength between the back of the thigh and the back of the pelvis, and reinforcement can be added if necessary. This region is subjected to a concentration of stress and strain in front and behind. This is caused by the patient trying to flex his body forwards or by a nurse mistakenly trying to lift the patient by the lower part of the plaster, perhaps to put a pillow under the knee. Extra strength is supplied behind by several plaques running obliquely from the back of the pelvis down the thigh. In front the strength should be further increased by using batwing plaques with a raised ridge at the point of antero-posterior strain.

#### *Assurance of good circulation*

A danger much more acute and disastrous than that of pressure sores or of paralysis from pressure on a nerve is that of the general compression of a limb which impairs or abolishes circulation. Compression, complete and not quickly relieved, causes gangrene; compression less complete may provoke ischaemic contracture or lead to a prolonged disturbance of the sympathetic control, associated with oedema, stiffness, and extreme osteoporosis. Compression almost always arises from subsequent swelling of the limb within the shell. It is desirable that compression should never be allowed to develop and it is essential that it should never remain unrelieved. Every plaster put on soon after a fracture or an operation should be split vertically from end to end; it is indeed a good policy to make this a standing order, though it is very often ignored by the young house surgeon. It is the practice with skin-fitting plaster to put a folded woolly bandage vertically along the limb

in the line on which it is to be cut. Then, when the plaster is just set but not yet rigid, two cuts in the plaster are made with a sharp scalpel about  $\frac{1}{4}$  inch apart until the bandage is reached. The narrow strip is completely cut out; short strips of bandage are tied round the plaster at two or three levels with a bow, thus the nurse can easily loosen the tie to allow of further expansion if necessary. Later, the plaster edges can be brought closer together if the limb shrinks inside the plaster. If necessary a further strip of plaster can be removed. Trueta attains the same end by the plaque method, which is quicker.

#### *Points in nursing*

*Position.*—When the patient is put back into bed, difficulties arise unless the ward staff is well trained in certain points. First, the lower limb must always be so well supported that no pressure ever reaches the plaster over the tendo achillis or the heel; as a rule a few pillows under the limb, with nothing under the heel, is all that is needed, and it is a good plan to take a fracture board from the lower end of the bed and put it as a second layer to raise the mattress under the knees.

Secondly, if the patient is in a spica plaster, a common mistake is to pack up his head and shoulders so that his chest or abdomen is forced against the upper rim of the plaster with very unpleasant results. The pillows should be so arranged that the body lies evenly supported on the plaster and on pillows just above it. With the patient lying in bed there should always be room for the whole hand to be inserted between the front of the body and the plaster.

*Drying.*—The plaster sets in a few minutes and then sweats for twenty-four hours. If the plaster is exposed during this period or covered with a porous blanket, the sweating is imperceptible and all is well; but if the plaster is covered up in bed it will be softened and ruined. No amount of heating and drying immediately after the application can eliminate the need for this precaution.

*Plaster sores.*—Sores are almost unknown with good plaster work and quite unknown if a good plaster is followed by good nursing. A patient in a big plaster can almost always be turned from side to side, often right over on his face: on such points the ward sister will be given directions by the surgeon. A change of position may be necessary to relieve the discomfort of a very thin patient, a patient who is tender, or one whose skin is poor from age or illness. Good nursing of this sort may even enable a patient to escape harm from a bad plaster.

The warning signs of a sore are often far from obvious, and there may be only a brief period of warning. First, the skin becomes reddened over the point of pressure: this is almost always associated with pain, though at times the patient will not mention it, or may



not even notice it during the hours of the day; almost always, however, the night nurse will observe a change from previous quietness to restlessness. Commonly a probationer has the best opportunity of observing her patients from night to night, and therefore it is a primary essential for the junior nursing staff to be taught the importance of the least nocturnal restlessness of any patient in plaster, to note it, and to underline it in the night report. This may be the only warning of a plaster sore, and the information should always be passed on to the surgeon so that he may have the opportunity of intervening.

The second phase within the plaster is the necrosis of the skin, and, since this deadens the sensitive nerve endings, the patient becomes more comfortable (*cf* gangrenous appendix).

The third phase is the deepening necrosis of the underlying tissues. By this time some discomfort will again arise, and a characteristic smell may be noticed, which, however, will have little chance of recognition where the plaster covers an open wound.

The development of plaster sores can only be prevented by the proper collaboration of the surgeon and his nurses. It is the duty of the surgeon to make his plasters even, smooth, and well-moulded inside; to arrange with his nursing staff that the patient be given frequent changes of position, if they make him more comfortable, and to insist that watch is kept for any localized discomfort or any nocturnal restlessness, and that he or his resident be immediately informed of any such warning symptoms.

### Conclusion

We have tried to write a practical account of plaster of Paris as a splintage medium; once its use is understood, it is easy to adapt it in all sorts of ways and we think that the creamed-fabric method needs first-class assistance. At the same time, the bandage and water are the bread-and-butter of plaster work; if a man is to plaster, he should be ready to go anywhere and do anything with a big tin of bandages and a bucket of water.

The observation of Trueta and Barnes (1940), that immobilization in plaster minimizes lymph flow, and therefore decreases the chances of absorption of bacteria and their toxic products, has been confirmed during treatment of hundreds of cases of wounds of limbs immobilized by plasters after air raids in England (Ross and Hulbert, 1941) and this should be regarded as an additional point supporting the treatment of septic wounds with plaster of Paris splintage.

Our thanks are due to Dr. C. D. Newman, Chief Medical Officer, E. B. Railway, for kindly allowing the publication of this paper.

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## GRANULOMATOUS ULCERS OF SMALL INTESTINE CAUSING ANNULAR STRICTURE AND INTESTINAL OBSTRUCTION

By M. G. KINI, M.C., M.B., M.Ch. (Orth.),  
 F.R.C.S. (Edin.)

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 (S. India)

STRUCTURE of the intestine causing acute intestinal obstruction is rare in Northern Circars and when it occurs is usually due to tuberculous or malignant ulcers or to sarcomata causing an annular stricture. The contents of the small intestine being fluid, obstructive symptoms occur in the later stages of the disease; at first they are of the nature of colic, with symptoms of chronic obstruction. Acute obstruction supervenes as a late symptom in these conditions. References to annular strictures due to granulomatous ulcers with no definite specific aetiology causing acute intestinal obstruction are rare. Out of 30 cases of intestinal obstruction from 1932 to 1940 only three cases of annular stricture due to granulomatous ulcers were found. In 1932 Crohn described a condition of regional enteritis with four distinctive phases in its clinical manifestation; this is now described in the literature as Crohn's syndrome.

- (1) The acute inflammatory stage resembling acute appendicitis.
- (2) The stage of ulceration causing enteritis associated with diarrhoea.
- (3) The stage of sclerosis resulting in obstruction, as in tuberculous conditions.
- (4) The stage of sinus and fistulous formation resembling actinomycosis and tuberculosis.

In most of the cases described by Crohn he found the pathology limited to the ileo-caecal region, but later he found the same pathology

### EXPLANATION OF PLATE XXXVIII

- Fig. 1.—The plaster must be well rubbed evenly and retained in the meshes of the bandage when preparing plaster bandages.  
 Fig. 2.—The correct way of putting a plaster bandage in warm water.  
 Fig. 3.—After all bubbling has ceased in the bucket the bandage is taken out and held between the index finger and thumb of both hands and given a twist. This deprives the bandage of excess water.  
 Fig. 4.—The plaster must always be applied obliquely and never in a circular manner. Obliquely applied plaster bandages are less liable to cause compression of the limb.  
 Fig. 5.—The plaster cast should be moulded with the flat of the palm and not with fingers otherwise internal ridges will result and cause pressure sores.  
 Fig. 6.—Polishing the plaster with a wet towel.  
 Fig. 7.—Showing a circular window in the plaster, a case of open fracture of the medial malleolus and infected ankle joint.

Note that the plaster on the sole must reach up to the tips of toes otherwise the toes are kept plantar flexed, due to gravity, and stiffness results. On the dorsal aspect it must cover up to the knuckles.

PLASTER OF PARIS IN THE TREATMENT OF WOUNDS AND FRACTURES:  
P. C. DATTA & B. S. AGARWAL



Fig. 1.

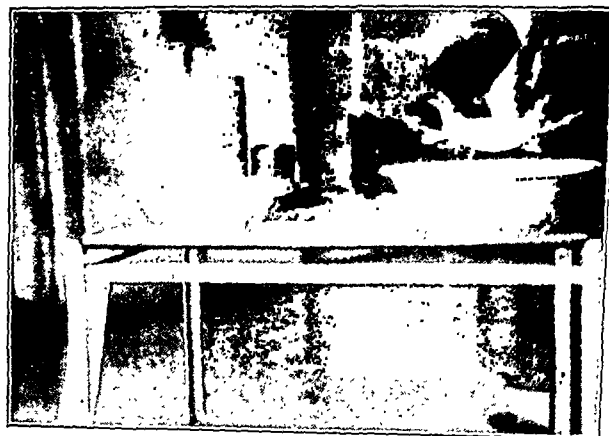


Fig. 2.

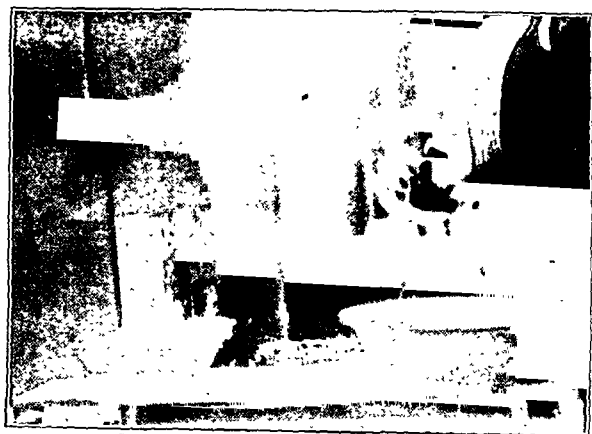


Fig. 3.

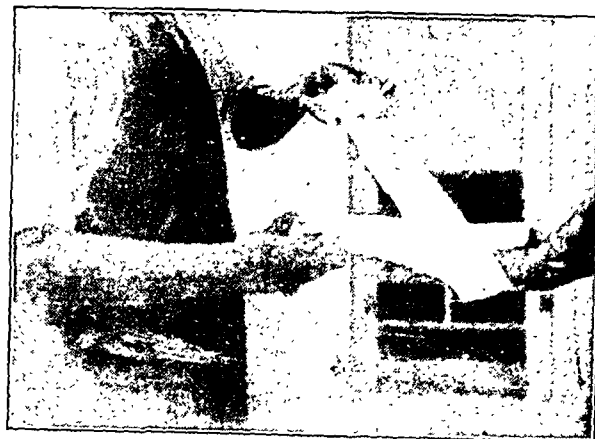


Fig. 4.



Fig. 5.



Fig. 6.

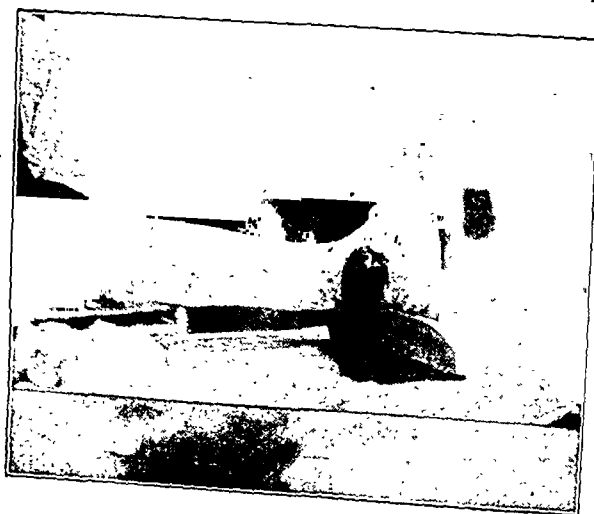


Fig. 7.



Fig. 1.

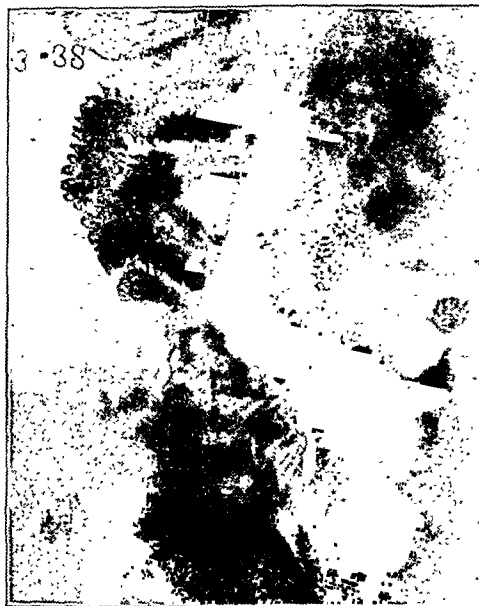


Fig. 2.

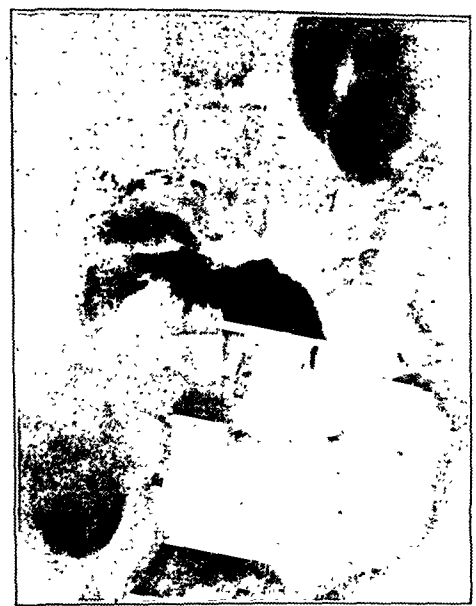


Fig. 3.

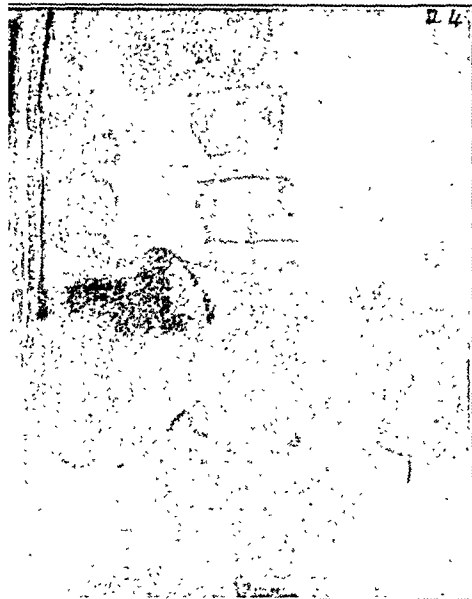


Fig. 4.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.

occurring in any part of the small or large intestine. In all these cases the obstruction is due to thickening of a segment of a bowel and not to annular stricture. The ulcers have been described as resembling granulomatous ulcers. Granulomatous ulcers have also been found in the region of the stomach and they resembled malignant ulcers clinically (Kini and M. N. Rao, 1938). Three cases of granulomatous ulcers causing acute intestinal obstruction on the top of a chronic progressive obstruction were found in the small intestine. In these cases the ulcers caused an annular stricture resulting in obstruction. In two cases the stricture was found in one situation of the ileum and in the third in two situations, 3 feet apart in the course of the ileum.

*Case 1.*—Mohammedan male, aged 19 years, was admitted on 18th February, 1928, with a history of colic of six months' duration. Six months before admission he had a dragging pain in the right inguinal region. Now and then he noticed slight swelling in the same region with distension of the abdomen. At the time of admission he was found to be moderately nourished with pyorrhœa alveolaris and angular stomatitis; the tongue was raw, moist and flabby. The conjunctivæ were pale and anæmic. The pulse was regular, of low volume and tension. Heart and lungs were found normal.

On examination, a swelling was found in the right iliac fossa and there were a lot of borborygmi. There was no external hernia. There were no glands palpable and nothing else abnormal was found. He constantly complained of colic which used to grow in intensity at intervals and was associated with distension of abdomen.

X-ray examination showed marked dilatation and hypertrophy of the small intestine, and obstructive changes (figures 1, 2, 3 and 4). The barium enema showed no abnormality.

One day he got acute obstruction and he was operated on under local anaesthesia supplemented with ethyl chloride and ether sequence. On opening the abdomen, the small intestine was found dilated. It was found difficult to isolate the cæcum. There were large mesenteric glands at what appeared like the ileo-cæcal angle, and a stricture was found in the lower part of the small intestine. The operation was done proximal to the stricture and the small intestine was sutured in layers. He was

The patient was re-admitted on 4th December with marked œdema of the feet and anæmia. He was treated on the medical side for his anæmic condition and sent home, and it is reported that he is keeping fair health.

*Case 2.*—A Hindu male, aged 41 years, was admitted on 4th December with a history of colic and inability to pass fæces and flatus, of four days' duration.

The complaint started six years before admission. It started with a feeling of fullness in the stomach three hours after the meals; he used to vomit undigested food obtaining some relief. The pain became severe after meals lasting three to four hours and was relieved by vomiting. One year prior to admission, flatulence became a noticeable feature; it was relieved by fomentations, the passing of wind and vomiting of bile. He had lost considerable weight and was admitted for continuous pain of a severe type of about four days' duration.

An ill-nourished individual of 40 years, anæmic, tongue moist and clean, teeth dirty and pyorrhœa alveolaris present. Heart and respiratory system were normal, but the pulse rate was 102 per minute, moderate in volume and tension.

The abdomen was scaphoid with rigidity in the epigastrium and peristaltic waves were found in the epigastric, umbilical and left lumbar region. The wave started in the right half of the epigastric region and

travelled down across the umbilical region to the left lumbar region.

Blood Wassermann—strongly positive.

Blood pressure—110/88 mm. of mercury.

X-ray showed marked hypertrophy and dilatation of the small intestine (figure 5).

A diagnosis of Crohn syndrome or tuberculosis of the intestines with obstruction was made, and he was operated upon under local anaesthesia by a right para-umbilical incision, on 13th September. On opening the abdomen, the proximal part of the jejunum and ileum was found hypertrophied and dilated.

About the middle of the small intestine a marked annular stricture was found with no tubercles on the peritoneal surface. The intermediate group of glands

was removed. The large bowel was found remarkably dilated; the stomach was normal. The abdomen was closed in layers.

The patient had a slight cough for a few days after the operation. He recovered. The specimen showed an extensive granulomatous ulcer (figure 6) which on histological examination was found to be infiltrated with plasma and lymphatic cells in the wall of muscular and serous coats. The mucous membrane showed extensive ulceration, and in places a perivascular reaction was found; no acid-fast organisms were found. The glands showed chronic inflammatory changes, but without evidence of tuberculosis.

He was discharged from the hospital and he reports on 20th March, 1940, that he is keeping perfect health.

He had put on about 20 lb. weight since he left the hospital.

*Case 3.*—A Hindu male, aged 60 years, a fisherman by occupation, was admitted on 28th June, 1940, for chronic intestinal obstruction with acute symptoms supervening. He was admitted on the medical side for colic and later transferred to surgical side for acute obstruction. He gave a history of venereal disease.

#### EXPLANATION OF PLATE XXXIX

Fig. 1.—A radiographic picture of the gastro-intestinal tract taken 5 minutes after administration of the barium meal. It shows the jejunum dilated and hypertrophied.

Fig. 2.—A radiographic picture taken 3 hours and 40 minutes after the administration of the barium meal showing obstructive phenomena.

Fig. 3.—Marked ballooning of the small intestine taken 6 hours and 30 minutes after the administration of the barium meal.

Fig. 4.—Taken 24 hours after the administration of the barium meal. Note the barium in the cæcum and the residue in the small intestine which is ballooned out to the size of a distended large bowel.

Fig. 5.—A barium meal picture taken 5 hours and 30 minutes after the administration of the barium meal showing dilatation of the small bowel and the barium meal is found in the large bowel.

Fig. 6.—A picture of the mounted specimen. Note a large shallow ulcer with undermined edges at the periphery. At one place the ulcer was cut for taking a block for histo-pathological examination. Note the dilatation of bowel stricture.

Fig. 7.—A barium meal picture taken 1 hour 15 minutes after the administration of the meal showing marked obstruction of the small intestine. Note enormous dilatation of the lumen of the small intestine.

Fig. 8.—Taken 48 hours after the operation of lateral anastomosis shows the barium has passed into the large bowel.

The duration was given as two months. It started as a pain in the umbilical region with gradual increase in intensity. The pain later was all over the abdomen and increased on taking food; there was a very uncomfortable sensation of something moving inside his abdomen. He used to obtain relief after vomiting, but since admission to hospital he had no vomiting. Appetite was poor and he had no history of hæmatemesis.

Abdomen distended and tympanitic; no free fluid, visible peristalsis found; coils of intestine were found to stand out in the ladder pattern; tenderness was present.

The urine was normal. Barium meal examination showed marked intestinal obstruction (figures 7 and 8).

He was operated on as an emergency under local anaesthesia by a right paramedian and para-umbilical incision. On opening the abdomen, dilated loops of small intestine were found to stand out. On exploration, two strictures were found in the middle of ileum about 3 feet apart and the rest of the bowel was found to be normal. There was no evidence of tubercle at the site of stricture or anywhere in the intestinal region. A lateral anastomosis of small intestine between each stricture was effected and the abdomen closed in layers. Resection was considered dangerous because of the poor condition of the patient.

The patient made an uneventful recovery and on re-examination by barium before he was discharged, it was found that the anastomosis was functioning very well. He has been re-admitted on 18th August, 1940, with marked anaemia and swelling of his feet. He was found to suffer from deficiency of vitamins for which he is being treated and he shows marked improvement.

#### Summary

(1) Three cases of chronic obstruction were admitted and the radiological picture of these three cases showed obstructive phenomena of the small intestine.

(2) They developed acute obstructive symptoms during the course of the investigations and so they were operated on as emergencies.

(3) At operation in case 1, the obstruction was found to be due to annular stricture, but excision could not be done as the patient's condition did not warrant such a procedure, so an ileo-transversostomy was done and he was discharged cured. The patient was re-admitted for anaemia for which he has been treated and now he is keeping fairly good health. Case 2 was operated upon, one and a half feet of the small bowel was excised, and an end-to-end anastomosis was done. The annular stricture was found to be due to a granulomatous ulcer which was responsible for this condition. The histopathological section and the naked-eye appearance showed that the intestine was markedly hypertrophied and dilated above the line of annular stricture and the bowel beyond was found collapsed. In case 3 there were two such strictures about 3 feet apart and this case was in such a bad state that excision of the strictures could not be done. He was re-admitted for anaemia for which he was treated with fair results. He is still under observation.

(4) Granulomatous ulcers causing strictures and obstruction whose specific origin is unknown

(Concluded at foot of next column)

## HEAD INJURY AND ITS MANAGEMENT

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It was common with the older writers to focus the attention to the effects of severe injury mainly to the calvarium, but, with the better understanding of the underlying physio-pathology of these injuries, our attention is now more drawn towards the effects of such injuries on the intra-cranial contents and less on the skull bones themselves. After all, sequelæ that follow a severe head injury are always due to damage to its contents, and the treatment, if it is going to improve the prognosis, must of necessity be directed towards such effect. For brevity I will not discuss the mechanism and distribution of various fractures of the skull bones.

Broadly speaking, any severe violence on the head will produce deformity of the skull.

(1) If the area of impact is limited, it may produce localized fracture (depressed fracture), with or without local laceration of the underlying brain.

(2) If the deformation is diffuse, it may produce fracture of the skull and as the base is the weaker area, often the line of fracture runs through it. The meningeal vessels being intimately adherent to the skull may also be torn with the fracture (middle meningeal hæmorrhage). Although middle meningeal hæmorrhage may occur without a fracture, in the majority of cases they are associated, a point worth remembering. Mention may here be made that incidence of middle meningeal bleeding is rather rare though the associated lucid interval has caught the imagination of many medical men.

In the last consecutive 100 cases that I have observed only three were suspected—one proved by operation and the last two by post-mortem examination.

(Continued from previous column)

are rarely described. The question of its being tuberculous has been considered. The naked-eye and histopathological section showed no evidence of tuberculosis (see case 2).

My thanks are due to the Radiologist Dr. P. Kesavaswamy and to Dr. Pisharoty for case 3 who kindly transferred the case for surgical treatment and to Dr. T. Bhaskara Menon for the photomicrograph and the histopathology.

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*The effect of general deformation of skull on the brain.*

The force of impact is transmitted through the brain substance and hence any injury that may follow is to be found along the track of transmission of such force. Thus there may be local laceration of the brain substance, or there may be major contusion on the opposite side, where it violently comes in contact with the skull (laceration by *contrecoup*). The injury being furthest from the site of injury, if not thought of, may altogether be missed. Furthermore along the track of force there may be microscopic injury to the brain substance, and also around the ventricular walls.

Based on this known pathology of the condition we may group the cases clinically as follows, remembering all the time the limitation of such stereotyped grouping.

**Concussion.**—Following a severe injury the patient loses consciousness; this is immediate and complete. During this period, with the exception of vital centres, all functions are

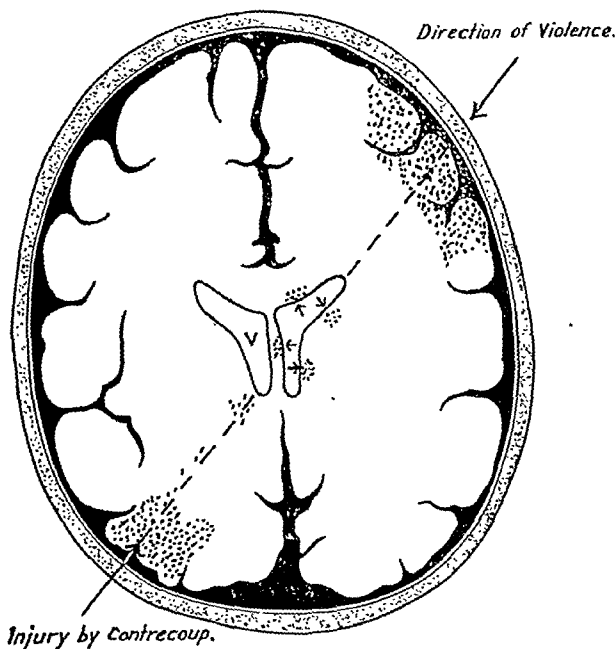


Fig. 1.

paralysed. After a short interval the patient recovers completely from its effect without any residual damage.

This is the clinical picture of a typical uncomplicated case of concussion and any prolongation or deviation of the symptoms or alteration in the recovery stage is due to added complications such as minute hæmorrhages or neural damage.

Trotter's explanation for this condition has been universally accepted, namely, that owing to energetic decompression of the skull there is hyper-acute cerebral anæmia and the resultant paralysis of most of the cerebral functions. This is the only understandable explanation of the condition and one on which we can base our treatment. But as the period of concussion is only a momentary phase of the

effect of the injury, naturally one should be on guard for the train of symptoms that may follow it, proving more severe organic damage to the underlying structures.

**Traumatic delirium.**—The patient after a prolonged state of concussion passes into a state of incomplete unconsciousness marked by heightened excitability. The patient lies on his side, resents light or any disturbance, and the reluctance to answer questions is often noted as unconsciousness, and he may even show exaggerated rage phenomena when disturbed. There is complete absence of any focal signs and symptoms. Often there is regular alternation of drowsiness by day and delirium by night. The pulse is full and the rate is variable but more towards the slow side. Temperature may or may not be raised and then only by a degree or so. The condition reaches its maximum on the second and third day and gradually subsides, if not interrupted by further complications.

Although this is the usual clinical picture, there are often present innumerable variations of symptom groups, and as the mental condition

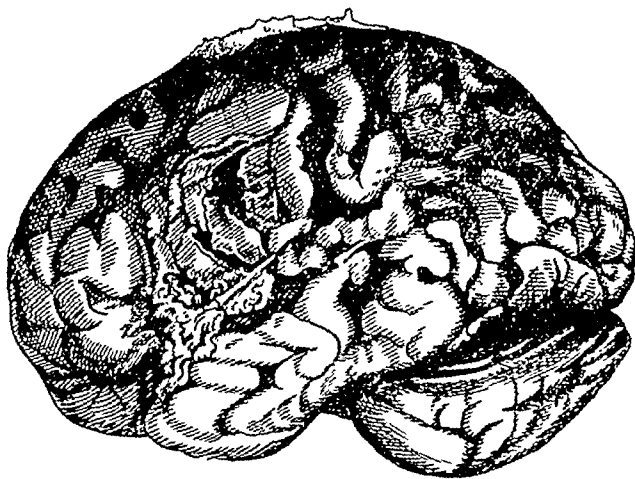


Fig. 2.

is of non-co-operation it is all the more important to take particular care in eliciting any signs of focal damage and recording progress of symptoms of clot compression.

The underlying path is explained by the occurrence of œdema following a severe injury, which is a natural result of all injuries. But there is very little space for accommodation of extra fluid without affecting the cerebral circulation; and as œdema follows, the increased pressure impedes the venous outflow in the surrounding capillaries and thus produces congestion of the part. It has been assumed, in severe injury, that there are present diffuse though minute areas of hæmorrhage and thus a generalized œdema and congestion of the brain is the result.

That this is not the only pathological change in this group of cases is obvious, and pointed attention has been drawn to this fact by various writers. The œdema and the resultant congestion must take time to develop, at least twelve



hours, but the alteration of mental condition is noticeable from the period of concussion and hence there must be neural damage or disturbance of cerebral function from the direct effect of trauma alone.

*Traumatic stupor.*—This forms the last group of cases and presents the greatest difficulty in determining the actual damage to the intracranial contents. The cases that do not show any improvement and in whom the unconsciousness is prolonged from the stage of concussion with gradual onset of bulbar paralysis and with death occurring within few hours of injury are due to damage of extensive nature, laceration of the brain or rupture of big vessels, and very little can be done for them.

But by far the largest group of cases show an interval between the period of concussion and the secondary onset of unconsciousness. During this interval, the period of which again varies from a few hours to days or even weeks, the patients show signs of cerebral irritability.

The underlying pathology of this condition of secondary unconsciousness is supposed to be due to clot compression.

The rise of pressure, owing to hæmorrhage, is essentially local at first and the area thus compressed becomes anæmic and there is loss of function or paralysis. As the pressure still rises it is transmitted to the opposite side and produces congestion and cerebral irritation of the opposite hemisphere first, and later on bilateral cerebral anæmia and paralysis. With the continuous rise of intracranial pressure supratentorial pressure presses down the mid-brain through the tentorial notch and thus strangulated, it brings forth the series of bulbar symptoms, first irritative, later paralytic.

Though this is the usual picture in traumatic stupor this is not the whole truth. That clot compression can and does produce secondary unconsciousness is of little doubt but that cerebral laceration without massive hæmatoma can also produce stupor, though disputed, is also a fact.

An example :—

*Case 1.*—Male, 20 years, knocked down by a car and was admitted on 24th January, 1939; unconscious; bleeding from the nose; pupils equal and dilated reacting to light; no paralysis; no subconjunctival hæmorrhage. Lumbar puncture—clear fluid.

On 26th unchanged mentally; talks incoherently; disorientation of time and place. No paralysis. Gradually symptoms cleared up and he was discharged on 25th February.

Here the syndrome is typical of laceration of the under surface of the frontal lobe and there was never anything suggestive of clot compression.

The drawing of the brain (figure 2) is another example of cerebral laceration with mental disturbance, ending fatally but absence of any clot compression.

*Anatomical varieties of intracranial hæmorrhage.*—By far the largest group of cases of

traumatic stupor are due to hæmorrhage and this may be sub-dural or extra-dural.

(1) *Sub-dural hæmatoma.*—This type is far more common than the extra-dural, and in the majority of cases, is due to moderate hæmorrhage, so that the pressure symptoms are delayed by days or weeks. The patient shows signs of prolonged cerebral excitability and signs of localized compression-paralysis sets in. Progress of symptoms from irritation to paralysis is the chief character of intracranial hæmorrhage and must be looked for.

In the majority of cases it is possible to localize the seat of hæmorrhage clinically and a few cases may be cited.

*Case 2.*—Male, 28 years, was admitted on 14th March, 1938. History of being struck by an iron rod on the right parietal region on 9th March. He was unconscious for three days then recovered incompletely.

*On admission.*—Patient was conscious but did not talk. He attempted to answer simple questions. When given food he took it regularly, never showed any irritability. There is paresis of the left side. X-ray showed a linear fracture over the right parietal eminence. He was improving but suddenly worsened and was operated upon on 20th March. There was huge sub-dural and a moderate extra-dural hæmatoma in the region. Recovery was uneventful.

*Arachnoidal hæmorrhage.*—This diffuses in the space and there is absence of any localizing signs. Lumbar puncture shows blood intimately mixed with the cerebro-spinal fluid.

*Intra-cerebral hæmorrhage.*—This is still rare. Compression symptoms usually take about a week before becoming apparent. But if it occurs in the silent area, vague symptoms are difficult to analyse and if the patient comes after a long time it is often confused with cerebral tumour.

(2) *Extra-dural hæmatoma.*—If the bleeding is from the middle meningeal artery there is practically no lucid interval. Patient shows incomplete signs of recovery from concussion, often becomes violent and then passes into unconsciousness again with the appearance of paralytic symptoms.

If the bleeding is moderate, especially venous, the lucid interval is prolonged a few hours then the compression signs appear. As regards classical compression symptoms, slow bounding pulse, Cheyne-Stokes' respiration and raised blood pressure, these are due to pressure on the bulb and are very late signs; one should endeavour to diagnose before they appear. I consider pupillary changes with hemiplegia are quite diagnostic of clot compression and alteration of mental condition is of the greatest help.

*Case 3.*—Male, 30 years, admitted on 22nd February, 1938. History of fall from a height of about 80 feet. On admission, bleeding from both ears. Fractures of four ribs on the right side. Patient deeply comatose and remained so till death. No reflexes elicited. Pupils equal but dilated and sluggish. Ultimately died in the forenoon of 23rd February.

*Post-mortem report.*—Huge hæmatoma on left fronto-parietal area. There is rupture of middle meningeal artery near its exit and at the site of fracture. Interesting points in this case are, absence of lucid interval;

no localizing signs and pulse throughout varied between 110 to 120 per minute.

*Depressed fracture.*—It results, as already mentioned, from localized deformation of the skull. Cases with local contusion, which may follow such fracture over the motor area of the cortex, may come later on with symptoms of Jacksonian epilepsy.

*Case 4.*—Male, 30 years. History of being struck by rod, on the parietal region. He was unconscious only for about half an hour and was up and about next day. Twelve days after the incident he had a convulsive seizure in left limbs. Since then having fits now and then and lately accompanied by loss of consciousness.

*Operation.*—There was an old scar filling a trephine hole and dura was adherent to the skull. There was a depressed fragment present over the motor area; pia mater is also adherent to scalp. No blood cyst found. Silver foil was interposed on either side of the skull, after proper mobilization and decompression. He developed temporary 6th nerve palsy. Discharged on 5th February with complete recovery.

Thus after covering in rather a sketchy way the important symptom changes and the related pathological condition, some observations may now be made about the management of such cases.

#### *Treatment*

The majority of cases of head injury, as met with in civil practice, if treated skilfully, recover without any ill effect. But it requires great attention and constant watch, together with competent nursing.

Leaving aside details, for the sake of brevity, an attempt will be made to bring forth only the salient points in such management.

The chief aim in all head injury cases is to counteract the bad effect of raised intracranial pressure and if not caused by clot compression one may succeed by conservative treatment alone; even in clot compression, the basic idea is the same—reduction of the compression effect by surgical means. Of course any accompanying complication will require special attention.

*Concussion.*—Treatment should be expectant as the exact sequelæ are not known. It is directed to combating shock and caution is necessary in administering stimulants.

Rest in bed for three weeks (both physical and mental) is a necessary safeguard against post-traumatic epilepsy, in all cases of severe, though uncomplicated, concussion. Strenuous exercises should not be allowed before three months and any return of symptoms—headache or mental changes—require immediate return to bed and careful watch for complications.

*Traumatic delirium.*—Here we are dealing with more-or-less diffuse bruising and oedema of the brain and our aim is to ensure rest to the patient and to lower excessive rise of intracranial pressure, and watch for developing signs of complications.

It is better to nurse the patient in a dark isolated room. To diminish the excitability,

sedatives are essential and bromides and chloral hydrate are usually sufficient. Luminal can safely be used when necessary. The doses required are often large, at the same time it is useless to dope the patient while the real indication is a decompression. If oral administration is difficult rectal medication is to be resorted to.

Lowering of the intracranial pressure is obtained as follows :—

*Magnesium sulphate enema :* This is a very useful method in the treatment of head injury. It reduces the excess pressure without any ill effect and can conveniently be repeated, thus, having a more-or-less continuous effect of decongestion. In an adult, about 6 ounces of 50 per cent solution is injected into the rectum under low pressure and after half an hour it is washed out with a plain water enema.

*Intravenous saline :* It is one of the most powerful means of reducing the intracranial pressure. With its first introduction, enthusiasm ran high but moderation came with experience and now it is held a valuable adjunct but with limited field of usefulness. Though there are a large number of adherents to using it in all stages, I do not think it is based on known physio-pathological findings. In large doses it reduces the pressure rather too rapidly and too much and it is always followed by quick return to the previous level or even higher. It is also futile, and even dangerous, in the early stage of head injury. When used, 15 per cent of 25 to 50 c.cm. of a 15 per cent solution is injected into the vein, where the C.S.F. pressure is recorded near the 300 mark. Fifty c.cm. of 50 per cent glucose may also be injected to lower the intracranial pressure.

*Lumbar puncture.*—As a diagnostic method it is to be done early. But for reduction of pressure it is not necessary to repeat it before 36 hours. The practice of doing it daily as a routine should be discarded. Caution is necessary when doing it in the presence of very high pressure, as too rapid reduction may cause impaction of the bulb and mid-brain in the canal below. As a safeguard it is imperative to use a manometer.

Persistent delirium, in the absence of clot compression, should be treated by decompression.

*Treatment of compression :* When clot compression is suspected the only treatment is decompression and removal of the clot.

If the mortality rate is to be improved upon one must be prepared to operate on cases of suspected clot compression. The passive attitude that is being taken in compression cases is largely responsible for the high fatality at present. Though decompression in such cases gives a better chance of recovery the patient may die of the effect of neural damage already undergone.

Operation is also indicated in compound and depressed fracture. Difficulty arises in cases

where underlying an apparent innocent scalp wound a linear crack is detected some time later by x-ray. Two cases have thus been lost following late septic meningitis. It is difficult to take the view to operate as a routine in all cases of linear fracture, particularly on the inner table accompanied by scalp injury, though on principle one should.

*Convalescence.*—In short it may be said that when the patient has become conscious and remains continuously so he passes into the stage convalescence.

To prevent post-traumatic neurosis, the patient is to be warned of early commencement of activity. All mental strain is to be avoided for a long time and also acts that raise intracranial pressure. Sedatives such as luminal should be continued for a long time.

*Some observations on one hundred consecutive cases of head injuries*

*Age factor.*—Only three cases out of twenty proving fatal were below 5 years of age. This is perhaps explained by the fact that there is more accommodating power in a child's calvarium than in case of an adult. Furthermore

*List showing deaths in relation to time interval following admission*

No.	Sex	Age in years	INTERVAL		Cause of death
			Hours	Days	
1	M.	30	60	..	Laceration of frontal lobe.
2	F.	45	..	11	Septic meningitis with fracture.
3	M.	45	..	11	Rupture of hæmatoma in ventricle.
4	M.	30	36	..	Extensive injury of brain and lung.
5	M.	1½	..	..	Brain protruded.
6	F.	70	..	30	Septic meningitis.
7	F.	2	60	..	Middle meningeal hæmatoma.
8	M.	45	3	..	Gun-shot wound through palate.
9	M.	28	12	..	Intra-ventricular bleeding.
10	M.	20	54	..	Large sub-dural hæmatoma.
11	..	9	20	..	Extensive laceration of brain.
12	M.	30	10	..	Laceration brain.
13	M.	20	..	30	Primary meningococcal meningitis.
14	M.	25	6	..	Extensive injury.
15	M.	4	18	..	Laceration brain. Meningeal hæmatoma. No fracture.
16	M.	35	4	..	Prolapsed brain.
17	F.	75	6	..	Laceration brain. No fracture.
18	F.	2	..	..	Extensive injury.
19	M.	40	..	3	Sub-dural hæmatoma by falx cerebri.
20	M.	30	..	9	Laceration brain.

(Concluded at foot of next column)

## LEPTOSPIRAL JAUNDICE IN ASSAM

By B. M. DAS GUPTA

(From the Department of Protozoology, School of Tropical Medicine, Calcutta)

CONSIDERABLE interest has been aroused by the recent discovery of infectious jaundice in Calcutta (Das Gupta and Chopra, 1937), and since then, material (chiefly blood sera) from cases of jaundice occurring in different parts of India, viz, Bihar, Bikaner, Simla and Deccan, have been received by the writer for examination for evidence of leptospiral infection. The

TABLE I

*Agglutination tests*

Strains of <i>Leptospira</i>	TITRE OF AGGLUTINATION			
	20	40	80	160
Strain Chopra, Calcutta (classical <i>Leptospira icterohæmorrhagiae</i> ).	+	+	+	+
<i>L. canicola</i> .. ..	+	+	+	+
Mg. Tin Tin .. ..	+	±	—	—
Andamans A .. ..	—	—	—	—
Andamans B .. ..	—	—	—	—

clinical features in most of these cases were not, however, suggestive of infectious jaundice and

(Continued from previous column)

extensive injuries are by nature commoner in adults.

*Fracture of the skull:* Out of about eighty-five cases clinically taken to be severe injuries only twenty showed fracture of the skull.

*Lumbar puncture.*—As a diagnostic procedure undoubtedly an important test but as a routine done in the ward it is of less significance (due probably to faulty technique) as a large number of reports show blood-mixed fluid.

It will be noted in the above list that 50 per cent of the deaths occurred within 24 hours of injury and another 25 per cent within 60 hours, that is 75 per cent died within three days of the injury. These deaths are always due to extensive injury to the intracranial contents and are obviously beyond treatment.

The cases of sub-dural hæmatoma might have been saved by early operation.

Three cases developed septic meningitis after 10 and 20 days. The third one is interesting in that he developed primary meningococcal meningitis with an uncomplicated head injury.

I take the opportunity of expressing my indebtedness to Dr. D. C. Chakravarty, for giving me all facilities in treating the above cases.

laboratory examination also failed to prove that leptospira was the causal factor. However, quite recently Mr. Watson of the Deamoolie Tea Estate, Assam, sent us a specimen of serum from a patient who was suspected to have been suffering from Weil's disease. The medical officer stated that eight cases of jaundice had come under his observation from June 1940 to July 1941, four having proved fatal. Agglutination tests and protection experiments were carried out with the serum.

TABLE II

Strains	TITRE OF AGGLUTINATION			
	100	1,000	10,000	100,000
<i>L. icterohæmorrhagiæ</i> ..	+	+	+	±
<i>L. canicola</i> ..	+	-	-	-

It is evident from the foregoing tables that the serum is strongly positive, agglutinating the classical *L. icterohæmorrhagiæ* in dilutions up to at least 1 in 10,000 and it also gives some para-specific reaction with *L. canicola* and Mg. Tin Tin. The latter strain was isolated by me from a case in the Andamans and found to be identical with a Java bat strain, 90 C.

#### Protection experiment

0.4 c.cm. of the serum under investigation was injected intraperitoneally into a young guinea-pig and six hours later the animal was inoculated by the same route with 2 c.cm. of virulent culture of the classical *L. icterohæmorrhagiæ*. As a control, another guinea-pig of approximately the same weight, which had received 0.4 c.cm. of normal human serum, was similarly inoculated with the culture. The guinea-pig inoculated with the patient's serum was completely protected, while the control animal developed severe hæmorrhagic jaundice and died. Post-mortem examination showed characteristic lesions and leptospiræ were present in large numbers in the liver and kidney emulsions. It would thus appear that the patient's serum contains sufficient protective antibodies and is homologous with the classical *L. icterohæmorrhagiæ*.

As far as we have been able to ascertain, this appears to be the first authentic case of infectious jaundice yet reported in Assam.

Our thanks are due to Mr. Watson and Dr. Pal of the Deamoolie Tea Estate for sending us the material on which this note is based.

#### REFERENCE

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## A NOTE ON THE OCCURRENCE OF LEPTOSPIROSIS IN BOMBAY

By M. N. LAHIRI

(From the Haffkine Institute, Bombay)

EPIDEMIC and sporadic cases of fever followed by jaundice suggestive of leptospirosis have been reported by workers from time to time in the city of Bombay, but so far none of these was supported by positive bacteriological findings. It has been emphasized that although diagnosis of leptospirosis can be made partly on clinical grounds, it cannot be regarded as completely reliable unless confirmed by laboratory examination. It is, therefore, not unlikely that for the lack of investigation by laboratory methods many cases might have passed unrecognized.

A survey of the literature shows that as early as 1907 Tucker described an outbreak of jaundice in one of the congested areas of Byculla; of the ten cases recorded in the paper nine proved fatal. No bacteriological studies were carried out. Parmanand (1922) studied seven cases of jaundice that came under his observation. The description of the symptoms no doubt conform to that of leptospirosis, but as in no case was the causal organism isolated by culture, the true nature of the disease remained undetermined. Liston (1922) received material from a fatal case in Santa Cruz; no spirochaetes were seen by him, but he did find in liver histological evidence of acute yellow atrophy.

Turkhud (1928) also claims to have seen a small epidemic of jaundice in Bombay due to leptospirosis, but the diagnosis was based entirely on clinical grounds.

More recently, Manohar (1940) studied a few cases of jaundice and also examined autopsy materials. No systematic bacteriological examinations were carried out and the causal organism was not isolated from any of them. Diagnosis was based partly on animal inoculation. Moreover, it is rather difficult to agree with the findings of the author in one case where diagnosis was arrived at by detection of leptospiræ in a sample of stool. Thus, it would appear that the laboratory confirmation is still lacking and it was considered worth while to undertake the bacteriological studies in such cases.

The following is a report of a case of jaundice with fever in which leptospira was isolated and the patient's serum gave evidence of high agglutination titre.

The patient was admitted in the Goculdas Tejpal Hospital and was brought to my notice by Dr. N. J. Modi, Honorary Physician. The patient was seen on the 11th day of illness suffering from fever, jaundice, headache and intense prostration. The history suggested acute onset with rigors and pain all over the body which made it practically impossible for him to move about in the bed. The examination of urine showed the presence of albumin, casts (both epithelial and granular), leucocytes and a few red blood cells besides bile salts and bile pigments.

The clinical picture was very suggestive of leptospirosis, hence special attention was centred on the laboratory examination of the materials from the case.

#### Laboratory findings

A blood sample was first collected and was examined microscopically, by cultural method and by inoculation into a guinea-pig.

**Direct examination of blood.**—Examination of the blood by dark-ground illumination and also of films stained by Fontana's method were carried out, but no leptospiræ could be detected.

**Culture.**—Two tubes of Vervoot's medium were inoculated with 0.5 and 1.0 c.cm. of the blood, respectively. There was no evidence of any growth in both the tubes which remained sterile for over a month when they were discarded.

**Animal inoculation.**—A young guinea-pig was injected intraperitoneally with 2 c.cm. of the patient's blood. The peritoneal fluid was systematically examined, but no leptospiræ could be detected. The animal remained alive and well during the observation period of six weeks.

**Serological examination of blood.**—Agglutination-lysis test:—The serum from a part of the specimen of blood which was cultured reacted to a titre of 1 : 160 against a classical strain of *L. icterohæmorrhagica*. The examination of blood samples collected subsequently showed a marked rise of titre and it may be mentioned that the one collected on the 34th day of illness gave a titre of 1 : 1,000,000, not only against the classical strain but also against a Bombay strain (Lahiri, 1941) of rat leptospira isolated here.

**Urine.**—The mid-stream samples of urine were collected beginning from the 13th day of illness to the 46th day. In all, twenty-three samples were examined. The centrifuged deposit did not show leptospiræ in any sample, either by dark-ground illumination or in stained films. Five c.cm. from each sample were inoculated systematically into guinea-pigs. The guinea-pig which received the urine collected on the 36th day of illness succumbed to the infection and at autopsy showed typical signs. The culture of the heart's blood of this animal gave a pure growth of leptospiræ.

**Protective experiments.**—Two guinea-pigs approximately of the same weight were taken. One was injected with 0.25 c.cm. of the serum from the specimen of blood collected on the 34th day of illness and the other was inoculated with the same amount of normal human serum to act as a control. Half an hour later both were inoculated with 2 c.cm. of a virulent culture of classical leptospira. The one which received the patient's serum remained alive, whereas the other died of leptospiral infection, confirmed by autopsy and cultural examination. The protective value was similarly tested against the patient's own strain isolated from his urine with the same result. In this case, 1.5 c.cm. of an emulsion of liver of a guinea-pig infected with

the patient's strain was used as the infective dose.

#### Comment

Taylor and Goyle (1931) recorded the value of blood culture as a method of diagnosis, if done between the 3rd to 6th day of illness; cultures made after the 7th day were invariably negative. Das Gupta and Chopra (1937) obtained positive blood culture from a case as late as the 9th day of illness. Although the chance of isolation of leptospiræ from the blood in the present case was not at all likely on the 11th day of illness, yet it was done on the ground that the patient was not sure about the exact date of the onset of the illness. Evidently the culture was made at the time when the infective period of the blood had already passed. As regards urine, out of twenty-three samples only one proved infective. This low infection rate may be ascribed to two factors, namely, the acid reaction of the urine and the presence of bile in it. Both these factors are not only inimical to the vitality of leptospiræ, but are also apt to destroy morphology so that their recognition becomes rather difficult. The possibility of the isolation of the organism from the urine of cases where blood culture is of no value is worth trial, although the method is a laborious one and entails the use of a large number of animals.

#### Summary

A case of leptospirosis is reported from whom the causative organism was isolated. The serological tests of this case are also recorded.

#### Acknowledgments

My thanks are due to Dr. F. N. A. Moos, superintendent of the G. T. Hospital, Bombay, for providing every facility, to Dr. N. J. Modi, physician, and to Dr. H. S. Patel, pathologist of the hospital, for their help in many ways. I am also indebted to Dr. B. M. Das Gupta, professor of protozoology, School of Tropical Medicine, Calcutta, for confirming the results of the serological findings.

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#### CORRIGENDUM

THE Formation, Evolution, and Healing of Tuberculous Cavities in the Lungs. By T. J. Joseph, B.A., M.B., B.S. (Mad.), F.M.R. (Rome). (Published October 1941, p. 592.)

In the above article, Plate XXXVII, opposite p. 594. Figures 1 and 4 should be transposed

## A Mirror of Hospital Practice

### EPHEDRINE POISONING IN A HUMAN SUBJECT

By M. N. DE, M.B. (Cal.), M.R.C.P. (Lond.)

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*(From the Department of Medicine, Medical College,  
Calcutta)*

ALTHOUGH unpleasant toxic effects of ephedrine are sometimes met with in susceptible individuals after therapeutic administration of the drug, actual poisoning by a large amount is not usually seen. All its pharmacological effects including those of lethal doses have been thoroughly studied in animals only. The following short communication will therefore, it is hoped, be read with interest.

A young boy of about 14 years had an attack of difficulty in breathing which was diagnosed as bronchial asthma. A prescription containing the usual anti-spasmodic drugs was given to him. Information was received afterwards on the 'phone that the spasms had become rather severe and the mother of the boy wanted something to be done for relief. At this, a telephonic instruction was given to his father, who was a medical man, to add  $\frac{1}{2}$  grain of ephedrine hydrochloride to each dose of the mixture. The doctor absently wrote 2 grains of ephedrine hydrochloride on the top of the prescription. This obviously signified 2 grains of the drug in each dose of the mixture. The prescription was taken to the nearest chemist's shop where it was served as written. The compounder did not note that an overdose of ephedrine had been prescribed; nor did he ask the prescribing doctor anything about it. The prescription having been served was taken to the patient who was given a dose of it at 1 p.m. The boy felt very ill within half an hour. This was reported to the father in his office who thinking it might be a severe attack of bronchial spasm instructed the mother over the 'phone to give a second dose of the medicine at 2-30 p.m. This however made the patient feel worse and he vomited probably a major portion of this dose. In this way he must have taken more than 2 grains of ephedrine within one and a half hours.

The symptoms, which appeared within half an hour, were of a very distressing nature. He felt sick, had vertigo and severe pain in the area of the heart with intense throbbing in the chest. One peculiar feature was that these sensations came on in successive bouts and he could tell his mother when he would get the throbbing. After they started, they increased gradually till they reached the fastigium, after which they slowly waned. After this another paroxysm would come. The palpitation and precordial pain appeared so violently and spasmodically that at the height of the attack the boy had to sit up and press hard with both hands on the cardiac area as if, as described by the patient in his own language, to prevent his heart from being forced out. This series of spasmodic attacks lasted for nearly two hours. He vomited frequently and could not retain even fluid. There was also considerable retching. He perspired profusely all over the body, his extremities were cold and he seemed to be in a state of collapse. He was very restless all the time. An exceedingly painful symptom was frequent desire to pass urine which he could not do owing to severe strangury. No blood was passed per urethram. Pulse was very rapid and feeble.

All these severe symptoms lasted for nearly two hours. When the patient was seen again at 4 p.m. the

same day he was just recovering and some of the symptoms were still present though with lesser intensity. It took him nearly the whole night to get over these symptoms and he felt relieved the next morning.

His asthma, however, disappeared completely.

### SUCCESSFUL ADMINISTRATION OF SULPHANILAMIDE TO AN INFANT\*

By BRIJ LAL BATRA, L.S.M.F. (Pb.)

*(Sir Biji War Memorial Hospital for Women, Bilaspur  
State, Simla Hills)*

A HEALTHY female child was born at the above hospital on 25th May last.

On the 20th day after birth the temperature rose from normal to 98.8°F. and it continued to rise steadily for the next four days until it reached 104°F. During this period the child was given an alkaline mixture, and glucose water and on the last two days, when the temperature was above 103°F., cold packs were applied, but there was no improvement.

The mother then drew my attention to an inflammatory condition of the vulva which was found to extend backwards around the anus and downwards on the inner sides of both thighs.

Half a tablet of prontosil rubrum (Bayer) was divided into four parts and given the same evening at two-hourly intervals. Boric fomentation every four hours and painting with 5 per cent mercurochrome was the local treatment. On the following day the axillary temperature was 100°F. No more prontosil rubrum was available so one tablet of prontosil album was divided into six equal parts and given every three hours. The same evening the temperature was 98°F. The fomentation was continued for one day more by which time all signs of inflammation had disappeared. The temperature remained below normal for the remaining eight days that the child remained in hospital.

#### Comment

This case is of interest because of the successful administration of prontosil to such a young child, with apparently no serious by-effects.

*Acknowledgment.*—I am thankful to Dr. S. N. Seal, chief medical officer, for his guidance, and to Dr. S. Brara, for her help in the treatment of the case.

### A CASE OF TWIN PREGNANCY—ONE UTERINE AND THE OTHER EXTRA-UTERINE

By A. G. PEREIRA, L.M. & S.

*District Medical Officer, Coimbatore*

A FEMALE, aged 21 years, was admitted into the Government Hospital, Tellicherry, on 7th February, 1941, with fever following abortion. An honorary assistant surgeon of the hospital had attended on her at her home and he extracted a foetus of about 4 months 13 days previously, and the next day he saw the placenta, which was expelled. He gave the history that previous to the onset of abortion she had pain and tenderness on the right side of the abdomen over the appendicular region and there was also rigidity with high temperature and he prescribed

\* Rearranged by Editor.



sulphonamide. The abortion took place the next day.

On admission into the hospital there was pain and tenderness in the right iliac region. There was also rigidity on the right side of abdomen. Temperature 102°F., pulse 122 per minute. She was put in Fowler's position. Urea sulphaside solution was injected and urea sulphaside tablets no. II were given orally (*t.d.s.*). The temperature came down to 100°F. on the 6th day and the pain on the right side decreased and she was on the way to recovery.

On 16th February the temperature rose again and a swelling began to appear in the lower part of the abdomen just to left of middle line. This steadily increased in size and extended a little above the umbilicus. The patient now began to show signs of distress—leucocytosis present. On 20th laparotomy was decided on. Under local anaesthesia the abdomen was opened by a left paramedian incision. The tumour was adherent to the peritoneum and, on opening it, foul-smelling dirty blood-coloured fluid with small streaks of pus escaped. There were dense adhesions all round but the hand could easily reach the right iliac fossa to the region of the appendix. It was thought inadvisable to put a drainage tube on the right side as there were dense adhesions and coils of intestine between the hand and the abdominal wall. Therefore a long tube was introduced up to the region of the appendix. Another tube was introduced in the direction of the the umbilicus and the abdomen closed.

She had a stormy convalescence. Profuse bloody discharge with flakes of slough were coming through the tubes and the dressing had to be changed morning and evening.

On 16th March a mass looking like omentum was protruding through the wound. It was ligatured and excised. On 18th another mass was seen projecting. It was also ligatured and excised. The excised portion contained 2 small bones—radius and ulna. The next day the projecting mass was slowly dragged out of the wound and excised. It contained a humerus and scapula. On 21st a mass was projecting. It was slowly dragged out and consisted of a macerated fetus about 4 months old.

Profuse discharge continued for a few days more. Now she has only a small sinus and it is healing quite satisfactorily and the patient is in good condition.

## A CASE OF TETANUS TREATED WITH SERUM AND MAGNESIUM SULPHATE

By N. C. PAUL, L.M.F.

*Assistant Medical Officer, Karimpore Tea Estate*

On the 22nd of March 1941, a tea garden coolie, aged about 16 years, attended the dispensary in the morning complaining of pain and difficulty in moving his neck. The symptoms were so slight that I took it to be a case of torticollis and prescribed accordingly. The next morning I was called to attend the boy in the lines.

### Examination.—

1. The patient was conscious.
2. Complete lock-jaw but could drink water with difficulty between spasms.
3. The patient was unable to turn himself on his side, the whole body was in a rigid condition and there were tonic spasms almost every minute, the body assuming the position of opisthotonos during contractions.
4. His temperature was 100°F. Bowels not moved and no micturition during the last 18 hours. The patient had no sleep during the night.

While examining him I found a small neglected ulcer on the dorsum of his left foot, which I was told was from a bamboo prick he received about a month ago, for which he applied tincture of iodine.

He was at once put in a dark room, the ulcer was cauterized with carbolic acid and regularly treated with antiseptic dressings and the following treatment was adopted:—

*23rd March.*—Morning—6,000 international units of tetanus antitoxic serum was given intramuscularly. 12 a.m.—Two c.cm. of 25 per cent magnesium sulphate solution intravenously and at 6 p.m.—6,000 international units of tetanus antitoxic serum—intravenously.

*24th.*—No improvement was noticed. Morning—6,000 units of tetanus antitoxic serum intravenously. 12 a.m.—Five c.cm. of 25 per cent magnesium sulphate solution intravenously and at 6 p.m.—6,000 units of tetanus antitoxic serum was given intravenously.

*25th.*—No definite improvement, except slightly longer intervals between spasms. 6,000 units of tetanus antitoxic serum was given intramuscularly in the morning, and 10 c.cm. of 25 per cent magnesium sulphate solution intravenously in the evening.

*26th.*—Definite improvement was noticed. Ten c.cm. and 5 c.cm. magnesium sulphate solution was given morning and evening intravenously.

*27th.*—A more definite improvement was noticed. Ten c.cm. of magnesium sulphate solution was given morning and evening intravenously.

*28th.*—Five c.cm. of magnesium sulphate solution was given morning and evening intravenously.

*29th, 30th and 31st March.*—No magnesium sulphate was given and the contractions began to appear after longer intervals ( $\frac{1}{2}$  to 1 hour or more) and not so severe as before. The general outlook of the patient was good though he could not open his mouth.

*1st and 2nd April.*—Five c.cm. of 25 per cent magnesium sulphate solution was given intravenously morning and evening.

*3rd.*—The patient could now sleep for a long time though there were some occasional contractions of a very slight nature. He could drink liquids and felt more comfortable, he also could open his mouth a little.

*4th.*—A purgative containing calomel followed by magnesium sulphate was given.

In addition to the above treatment, the patient was given a mixture containing potassium, sodium and ammonium bromide and chloral hydrate gr. x each four times daily and an occasional dose of mist. alba. The ulcer of the foot was dressed with eusol lotion. Plenty of drinks containing soda water, glucose with vitamin D and milk were given during the attack and from the 5th April rice and milk diet was given to start with, gradually increasing to his normal diet.

Points of interest in the case are:—

1. Severe tetanic convulsion developed from a neglected superficial ulcer on the foot from the prick of a bamboo stick after one month.
2. A relatively small dose of tetanus antitoxic serum was used yet the patient recovered. Total serum used 30,000 international units.
3. The effect of 25 per cent magnesium sulphate solution was very encouraging; the dose of 10 c.cm. was more effective than the smaller doses of 1 c.cm. to 5 c.cm. The intravenous route of the injection was adopted owing to the severity of the case. Total magnesium sulphate solution used—82 c.cm.

I am grateful to Mr. C. T. Cramphorn for his permission to report this case and to Dr. N. N. Ghose for his advice in managing it.

# Indian Medical Gazette

NOVEMBER

## THE BIOCHEMICAL STANDARDIZATION LABORATORY

It is eleven years since the Drugs Inquiry Committee revealed a highly unsatisfactory state of affairs to be in existence in the conduct of the drug trade in India. They found that adulteration was rife, that many mixtures did not contain the amount of the various drugs they were stated to contain, and that the drugs themselves were often far below the standard quality required by the British or United States Pharmacopœias, which are the standards generally accepted in India. A beginning was made in 1937 to remedy the bad conditions brought to light by the report of this committee, by the establishment of a Biochemical Standardization Laboratory whose function is to test and check the various products on sale in India for the treatment of disease.

The first report issued from this laboratory has recently been received\*. It covers the first three years' operations, and the amount of work in testing drugs has been considerable, especially in view of the limited staff and laboratory accommodation that has been made available.

Formerly, when drugs were confined almost exclusively to plant products or simple inorganic chemical compounds, testing their purity and pharmacological activity was a relatively simple matter and therefore did not require a very large establishment nor a particularly highly qualified staff, and the present laboratory accommodation and staff would probably have been sufficient to do the greater part of the testing then necessary. Now, it is a very different matter because, in addition to the above kinds of drugs, several other distinct groups of important remedies are being used in great quantities. For example, there are gland extracts, highly complicated organic compounds, specific sera and vaccines, and the vitamins. No single expert nor any single laboratory can hope to cope successfully with the standardization of all the compounds and products included in the above groups, because they differ so widely in their composition and processes of manufacture that very many entirely different methods have to be employed in their assay.

To give one example—an important method of drug testing, and one that is now widely employed and is the only satisfactory method for many products, is biological assay, that is the testing of products by their action on

animals. For the accurate reading of results by this method perfectly healthy and as far as possible identical animals regarding age, weight, colouring, etc., are needed. To have an adequate supply of such identical animals always available necessitates the maintenance of hundreds or thousands of the species in use, and even for small animals such as mice very extensive animal-house accommodation is required. Therefore, on the grounds of the limited space available and the difficulty of maintaining healthy laboratory-bred animals in the Calcutta climate, it is doubtful if the present laboratory will be adequate when it has reached the full working capacity that will be needed to cope with the tremendous amount of work that will have to be carried out, if it is to prove an efficient instrument in the control of all the drugs and other products used in India in the treatment of disease.

While we welcome this report and congratulate its director, Colonel Sir R. N. Chopra, and his staff on the amount and the quality of the work they have performed with the facilities at their disposal, we wish to take this opportunity of emphasizing the fact that this laboratory in its present form and situation can only be regarded as the small beginning of what must in time be developed into an extensive organization.

It may be said that owing to the enormous expenditure that the country has to meet in upholding its share in the Empire war effort money is not available for the necessary expansion of this drug standardization laboratory. However great the national expenditure may at present be in other directions, we feel that the necessary funds should be found somehow, because the international situation makes the rapid expansion of the laboratory urgent, as the war has suddenly placed upon it a very much augmented volume of work, which in peace time might have been assumed more gradually.

The overseas supplies of nearly all drugs are very much reduced and in many instances completely discontinued. The result is that locally manufactured drugs and biological products have suddenly become of much greater relative importance. Many of the countries of Europe and America from which we obtained by far the greater quantity of remedies before the war already had legislation in force to ensure the purity and strength of their pharmaceutical products; so that drugs emanating from well-known manufacturing houses in these countries could largely be taken on trust, thus local assay was not of particular importance in most cases. This sudden stoppage of overseas supplies has led to a rapid expansion of local drug manufacture, and it is still far from fulfilling the demand. Many of the firms engaged in India on this type of industry are sound concerns with good laboratory accommodation and efficient staffs, and they turn out materials

\* See abstract on p. 699 of this issue.

that are up to standard, but unfortunately there are many others with inadequate laboratory equipment and staff who may be trying honestly to do their best but are incapable of carrying out correctly the highly technical operations needed in making modern drugs, and there is a third class of manufacturers who are deliberately placing on the market remedies of inferior quality in the hope of making large profits out of our present emergency.

There are two aspects to this situation; there is the point of view of the health of the people, for it is to the drug standardization organization that we must look for ensuring that safe, pure and potent drugs are placed on the market, and the commercial aspect. The present situation has provided pharmaceutical manufacturers in India with a great opportunity which they will be unable to exploit to the full unless the standard of drug manufacture is maintained at its proper level by legislation backed

by a drug standardization organization suitable to the requirements. Otherwise the opportunists, the third class of manufacturers mentioned above, whilst making their own quick profits will ruin the name of the Indian drug industry. Imported drugs always cost more, but hitherto they have been readily purchased because people believed, rightly or wrongly, that on the whole drugs manufactured in India were of inferior quality. Now in many instances they can only buy locally manufactured drugs and on the opinions they form while the present situation lasts will depend their attitude towards Indian manufactured drugs in the future and whether they return once more to drugs of foreign origin. Strive how they will, individual manufacturers cannot save the situation unless they receive the support of the Government. *Now not after the war* is the time, therefore, to expand the drugs standardization organizations in India.

## Special Article

### HÆMATOLOGICAL TECHNIQUE

#### PART XIII

By L. EVERARD NAPIER, F.R.C.P. (Lond.)  
and

C. R. DAS GUPTA, M.B. (Cal.), D.T.M.  
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#### BLOOD GROUPING AND BLOOD TRANSFUSION

*Historical.*—After Harvey's discovery of the circulation of the blood, Sir Christopher Wren in 1650 injected opium, beer, etc., into the veins of dogs, using quills as cannulae, but the first transfusion of blood was given by Richard Lower in 1665; he transfused blood from one animal to another of the same species, using dogs mostly as his experimental animals. The credit, however, for performing the first transfusion in man is usually given to Denys de Montpelier, physician to Louis XIV.

After this, transfusion was indiscriminately used as a curative agent in all diseases and in many cases animals were used as donors. So many deaths followed this indiscriminate use of transfusion that the operation was banned by the Royal Society in England and by the Académie de Médecine in France, and was condemned by the Pope as immoral. Blood transfusion then fell into disuse as a therapeutic measure for about 150 years, being revived in 1818 by James Blundell, an obstetrician in Guy's Hospital. For the first time, he gave transfusion through a syringe in cases of post-partum hæmorrhage and claimed immediate success. He was of the opinion that transfusion by the new technique was 'a very feasible operation' which 'after undergoing the usual ordeal of neglect, opposition and ridicule will hereafter

be admitted into general practice'. By this method, whole blood was used for transfusion until 1835 when Bischoff first introduced defibrinated blood for this purpose and showed that it was safer, as it obviated the dangers of coagulation. However, the transfusion of both whole and of the defibrinated blood still resulted in death very frequently, and it was not until early in the present century that transfusion of blood was firmly established as a dependable therapeutic agent. In 1900, Landsteiner, an Austrian biochemist, made the crucial discovery of the presence of iso-agglutinins and iso-agglutinogens in the blood. On the basis of Landsteiner's discovery, Jansky, a Czechoslovakian, and Moss, an American, independently showed (1907-08) that the blood of the human race belonged to one of four groups—I, II, III and IV with this difference however that Jansky's groups I and IV corresponded, respectively, to groups IV and I of Moss; groups II and III being identical in the two cases. To do away with the confusion caused by the two different nomenclatures, recently an international committee of the Health Organization of the League of Nations introduced a simplified and rational nomenclature for the four main blood groups which they called AB, A, B, and O. The international nomenclature of the blood groups and those of Jansky and Moss are shown in the table below.

International nomenclature	Moss nomenclature	Jansky nomenclature
AB	I	IV
A	II	II
B	III	III
O	IV	I

**Hæmagglutination and blood groups.**—The transfusion of blood requires the use of compatible blood, that is, blood in which the corpuscles of the donor are not agglutinated, or hæmolyzed, by the plasma of the recipient (the patient), and the corpuscles of the recipient are not agglutinated, or hæmolyzed, by the plasma of the donor.

The phenomenon of hæmagglutination is due to the fact that there are in the blood of man iso-hæmagglutinogens in the red corpuscles and iso-hæmagglutinins in the plasma; there are two main iso-hæmagglutinogens, A and B, that occur in the red cells and two corresponding agglutinins  $\alpha$  and  $\beta$  in the plasma. It is possible to divide mankind into four main groups according to the agglutinins and agglutinogens that are found in their plasma and red cells, respectively. Agglutinogens are present in the red cells of an infant from birth but specific agglutinins only make their appearance after some time. Both increase in titre up to the age of puberty, after which the titre of the agglutinogens remains stationary but that of the agglutinins gradually diminishes and is very low in old age. Both the agglutinin and agglutinin remain constant qualitatively throughout life. These four groups are as follows:—

Group (International nomenclature)	Agglutinogens in red cells	Agglutinins in plasma (or serum)
AB	A and B	none
A	A	$\beta$
B	B	$\alpha$
O	none	$\alpha$ and $\beta$

It is thus the agglutinogens in a person's red cells that give the name to his group, though by simple deduction it is possible to ascertain his group from the agglutinins in his plasma (or serum). When A agglutinin (in the red cells) comes in contact with  $\alpha$  agglutinin (in the plasma) agglutination takes place: similarly agglutination takes place when B agglutinin comes in contact with  $\beta$  agglutinin.

The arrangement of agglutinogens and agglutinins is always such that in any single individual auto-hæmagglutination will not take place, but the fact that in the human race there are four different groups of individuals precludes the indiscriminate mixing of blood of different individuals *in vivo*. Provided bloods are of the same group they can usually be mixed with safety; for example, group AB blood can be given to an AB individual, because neither the donor nor the recipient has  $\alpha$  or  $\beta$  agglutinins in his plasma to act with the A and B agglutinogens in the red cells and cause agglutination, but AB blood cannot be given—to an A individual, because he will have  $\beta$  agglutinins in his plasma which will act with the B agglutinin in the donor's red cells and agglutinate them, to a B individual, because of

the  $\alpha$  agglutinins, or to an O individual, because he has both  $\alpha$  and  $\beta$  agglutinins.

On the other hand, in an O blood there are no agglutinogens, so that, such a blood can be given with safety to any person of his own group, or as far as the donor's red cells are concerned any other group, and for this reason such an individual is sometimes called a 'universal donor'. However, in the plasma of the universal donor there are agglutinins, both  $\alpha$  and  $\beta$ , and these are capable of acting on the appropriate agglutinogens in the recipient's red cells; agglutinins are always weaker than the agglutinogens, so that, in practice, if the blood is given slowly, the agglutinins in the donor's plasma become diluted with the recipient's plasma, and no agglutination of the recipient's red cells takes place, unless, as sometimes happens, the agglutinins are present in exceptionally high concentration (high titre); a person who has agglutinin present in high titre is known as a 'dangerous universal donor' and his blood should only be given to an individual of his own group.

Now let us consider the position from the point of view of the recipient; A, B, and O persons have in their plasma  $\beta$ ,  $\alpha$ , and both  $\alpha$  and  $\beta$  agglutinins, respectively, and can therefore receive blood only from persons of their own groups, that is, persons who have not the corresponding agglutinogens in their red cells, but an AB person has no agglutinins in his plasma, so that he can receive red cells of any group, and consequently an AB person is known as a 'universal recipient'; however, his red cells contain both A and B agglutinogens and therefore, if plasma from an A, a B or an O person which happens to contain a high concentration of agglutinins is given, his red cells may be agglutinated.

For these reasons it is always essential that direct matching should be done before the blood of a universal donor is given to anyone except a person of his own group, or the blood of anyone except a person of his own group is given to a universal recipient. Further, as there are a number of sub-groups in the main blood groups—especially in groups A and AB, and as an extra check against mistakes, even when blood is given to a person of the same group, it is advisable, except in cases of great urgency, to do a direct matching, that is a matching of the donor's plasma with the recipient's red cells and *vice versa*.

## A. GROUPING

**Collection of blood for grouping.**—Grouping of blood can be done with a drop of blood obtained by pricking a finger or the ear lobe, but it is best done with washed red cells and the result checked by the cross identification of the agglutinins in the serum.

Collect about 3 c.cm. of blood aseptically in a dry syringe, put 2 c.cm. in a dry labelled test-tube, and 1 c.cm. in another

labelled tube containing 3 to 4 c.cm. of citrated saline (1.5 per cent sodium citrate in normal saline). *Write the name and full description of the individual on the labels of the tubes.*

Wash the red cells in the citrated saline tube three times with normal saline\*. Finally, make a 5-per-cent cell suspension in normal saline. The cells are now ready for use.

The blood in the other tube is also centrifuged, and the clear serum is then transferred to another labelled tube on which the name and description of the patient is written again—this is an important detail neglect of which is liable to lead to serious mistakes, and it must be emphasized that such mistakes may be fatal. The name should at the same time be entered into a register and a serial number given which should also be written on the label.

#### Apparatus and material required—

- (i) Known high-titre  $\alpha$  and  $\beta$  sera†.
- (ii) Known A and B cells—washed but not diluted‡.
- (iii) Glass slides 3 inch  $\times$  1 inch.
- (iv) Glass pencil.
- (v) Capillary pipettes with rubber teats.
- (vi) Small solid glass rods with a diameter of not more than  $\frac{1}{4}$  inch and with the ends rounded off.
- (vii) Black-and-white tile (figure 1).
- (viii) Hand lens.

\* The washing of the red cells is done in the following way:—Centrifuge the blood in the citrated saline tube until the supernatant fluid is clear; carefully pipette off the supernatant fluid, add an equal volume of normal saline, centrifuge again, and again discard the supernatant fluid; repeat the process a third time.

† When doing grouping of blood for the first time, known high-titre  $\alpha$  and  $\beta$  sera should be obtained from any reliable institution where blood grouping is done as a routine. Serum, collected aseptically and kept in rubber-capped vials in a refrigerator, will keep for 6 months or more, provided the serum is removed aseptically with a sterilized syringe. For subsequent use high-titre  $\alpha$  and  $\beta$  sera should be collected from time to time to replenish the stock from the subjects whose bloods are grouped. In places where blood grouping is done only occasionally, the groups of the personnel of the laboratory, hospital or dispensary should be ascertained, so that in an emergency grouping of an unknown sample of blood can be carried out with  $\alpha$  and  $\beta$  sera collected from among them, even if the agglutinins are not present in high titre.

A high-titre serum is one which will agglutinate the appropriate red cells in a dilution of at least 1 in 10.

In some countries, dried high-titre grouping sera,  $\alpha$  and  $\beta$ , are now available; such sera are supplied in powder form and are reconstituted by the addition of saline. The advantage of these is that they are easy to send any distance, they keep almost indefinitely, and they can be reconstituted to form a hyper-concentrated solution.

‡ Known A and B cells must always be collected freshly from persons known to belong to A and B groups, for even when collected aseptically and kept in a refrigerator, the cells hæmolyse in a few days and are not suitable for use. There is also a danger in using stored cells as hæmagglutination has been found to occur when stored cells come in contact with bacteria, especially of the corynebacterium group, which may be present in the glassware used in performing the test (Thomsen's hæmagglutination phenomenon).

(ix) Moist chamber (figure 2). This can be prepared by placing a piece of filter paper at the bottom of a petri-dish and keeping it wet with water. Two glass rods, of equal calibre are placed across the diameter of the petri-dish about 1 inch apart with a piece of glass rod of a smaller calibre inserted in between the two long glass rods to keep them apart. It is then kept covered.

(x) The unknown washed 5 per cent red cell suspension in normal saline.

(xi) The unknown serum.

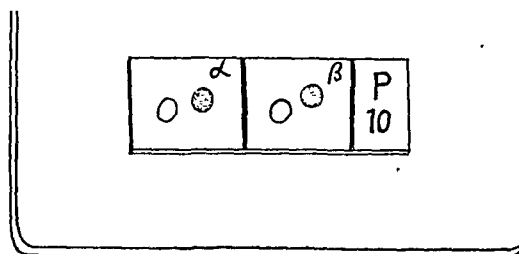


Fig. 1.

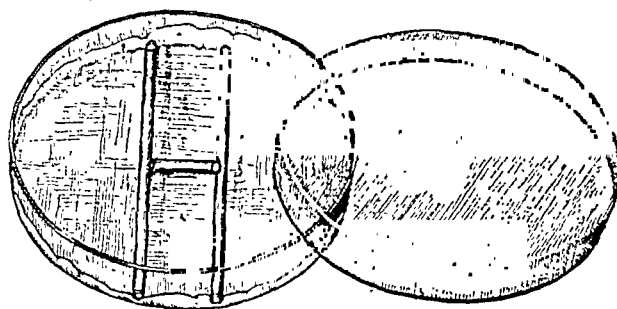


Fig. 2.

**Procedure.**—To ascertain the group of an unknown sample of blood, mix the unknown red cells separately with each known high-titre serum which contain  $\alpha$  and  $\beta$  agglutinins, respectively, wait for a few minutes, and then examine for the presence or absence of agglutination, which will indicate the group of the unknown cell as shown below.

Example	1	2	3	4
$\alpha$ serum (from group B) + unknown cells.	+	+	O	O
$\beta$ serum (from group A) + unknown cells.	+	O	+	O
Group to which unknown blood belongs	AB	A	B	O

+ denotes agglutination.  
O denotes no agglutination.

**Technique.**—Place a clean glass slide lengthwise on the white portion of the tile in front of you. With a glass pencil put a mark across the slide half an inch from the right end of the slide, and with another mark divide the remaining portion of the slide into two equal portions. Write the letter  $\alpha$  on the upper right-hand corner of the extreme left portion, the letter  $\beta$  on the upper right-hand corner of the middle portion, and the number of the unknown sample of blood on the extreme right-hand portion of the slide (see figure 1).

Place a drop of  $\alpha$  serum on the slide in the area marked  $\alpha$  and a drop of  $\beta$  serum in the area marked  $\beta$ .

Rotate the tube containing the unknown cells between the palms of your hands to get a uniform suspension of the cells. Withdraw a little cell suspension with a pipette and put a small drop of it by the side of, but not in contact with, the  $\alpha$  serum, and another drop by the side of the  $\beta$  serum. Mix each combination well with the glass rod using one end for each

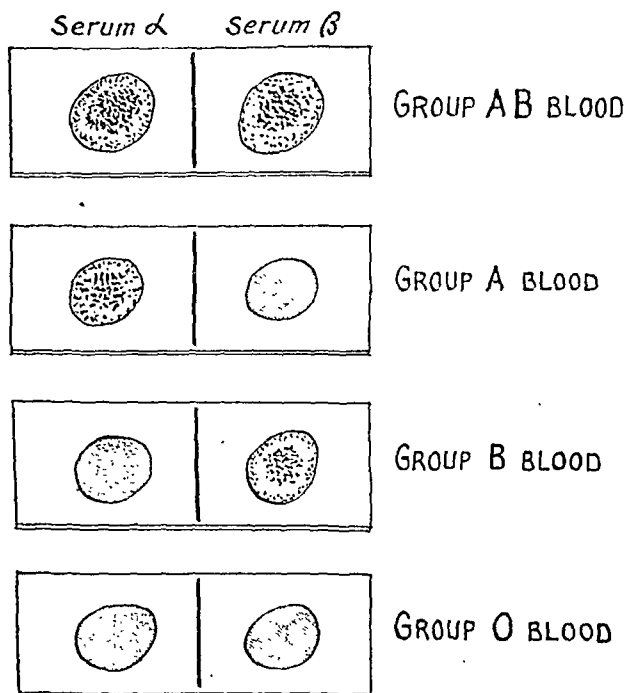


Fig. 3.

and then tilt the slide backwards and forwards to get an intimate mixture of the cells and the serum. Place the slides on the glass rods of the petri-dish over the moist filter paper and keep them covered (see figure 2).

Examine for the presence of agglutination after 10 minutes. In most cases clear-cut results are obtained but if there is any doubt about the presence of agglutination examine with a hand lens or under a microscope; this will enable one to distinguish it from the *pseudo-agglutination* that is occasionally seen in certain pathological states. In *hæmagglutination* real clumping of the cells occurs, whereas there is

(Concluded at foot of next column)

## Medical News

### TRAINING OF FIRST-AID PARTIES FOR A.R.P. GOVERNMENT GRANT TO ST. JOHN AMBULANCE ASSOCIATION

To assist the St. John Ambulance Association in training first-aid personnel for the air-raid precautions services, the Government of India have given the Association a grant-in-aid of Rs. 10,000.

The Association is already training staff for first-aid posts and parties, and it is hoped that it will provide a sufficient number of trained personnel, either members of the St. John Ambulance Brigade Overseas, or those holding the first-aid certificates granted by the Association, for all the first-aid posts and parties which will be needed under the air-raid precautions organization.

(Continued from previous column)

only rouleaux formation of the cells in pseudo-agglutination. If there is still any doubt, shake the preparation gently by tilting the slide backwards and forwards, when clumping due to hæmagglutination becomes marked but that due to rouleaux formation will often tend to disappear. If there is still any doubt, the unknown cells in the tube must be centrifuged and the test repeated with a more diluted cell suspension, when clear-cut results will be obtained (see figure 3).

For corroboration, a further test with the unknown serum may be made. The unknown serum is mixed with known A and B undiluted washed cells, when one of the following combinations of reaction will occur, indicating the group of the unknown serum.

Example	1	2	3	4
Cells of group A + unknown serum	O	O	+	+
Cells of group B + unknown serum	O	+	O	+
Group to which the unknown belongs	AB	A	B	O

Very rarely undiluted serum will exhibit a peculiar inhibitory property and agglutination will not occur, but agglutination becomes quite evident when the serum is diluted, this is known as the *prozone phenomenon*.

### B, DIRECT MATCHING BEFORE TRANSFUSION

This should be done not only the first time but on each occasion that a donor gives blood to a particular recipient, because instances have occurred when bloods that were compatible at the time of the first transfusion have on a subsequent occasion shown a degree of heterogeneity and some agglutination has resulted.

**Technique.**—One drop of 5-per-cent washed cell suspension of the donor is placed by the side of one drop of the serum of the recipient in one section of the slide, and, in the other, one drop of serum of the donor by the side of one drop of 5-per-cent washed cell suspension of the recipient. Each pair is mixed as in the original grouping procedure, and in due course the two mixtures are examined for agglutination. If in neither case there is any agglutination, this confirms the fact that the bloods are compatible.

(Transfusion technique will be given in the next issue.)



The provincial St. John Ambulance Organizations are arranging special classes in towns at which A.R.P. measures are being adopted, in order to produce the full quota of trained men to meet the requirements of the A.R.P. organization. An officer has also been appointed at the Association's headquarters to assist provincial centres with training schemes and to act as liaison officer between these centres and headquarters.

A number of officers of the St. John Ambulance Brigade are to be trained at the air-raid precautions school in Calcutta, to qualify them to train other personnel.

### THE PHARMACEUTICAL JOURNAL (1841-1941)\*

A CENTURY of useful existence for an organization is a fitting event to commemorate and the idea of issuing a special number of the *Pharmaceutical Journal*, the official organ of the Pharmaceutical Society of Great Britain, on the occasion of its centenary, is a very welcome one and should be appreciated in all quarters. A cursory glance through the pages indicates that the editorial board has spared no pains in making the issue an attractive one. Replete with advertisements, illustrations of historical interest, and sketches of pharmaceutical instruments and apparatus, the volume immediately attracts the attention of the reader. To those associated with pharmaceutical education, trade and industry, the pages offer very valuable and interesting information on the events associated with the evolution and growth of a century of organized British pharmacy. It is a copy worth while possessing for one's personal library.

Starting with an article on the 'Origins of the Pharmaceutical Society' which, by the way, forms a very good setting for the narrative which follows, a series of illustrated articles are presented bearing mainly on the historical aspects of pharmaceutical legislation, retail pharmacy and shop routine during the last 100 years, apprenticeship in the early days, hospital pharmacy in the centennial period, developments in pharmaceutical apparatus, and the growth of the trade in proprietary medicines since the days of the establishment of the society in 1841. Written by eminent pharmacists, the articles are extremely interesting and informative.

As pharmacy is a handmaiden to medicine, and has depended much on the progress of the medical sciences, the broad lines along which medical science has progressed from empiricism and scepticism to rational conception of diseases based on bacterial theory of causation and their treatment by means of chemical and immunological measures, are also briefly outlined. Under the caption 'Honoured Names in Pharmacy' a biographical account, with photographs wherever available, is presented of some of the founders and pioneers of the Pharmaceutical Society of Great Britain. This is followed by a short descriptive note of nearly 43 British pharmaceutical manufacturers who have carried on trade in drugs and medicinal chemicals for over 100 years. Many of these firms are well known in the world markets for ethical trading in drugs of all descriptions.

The reviewer is particularly happy to have been afforded the privilege of writing a note on this special edition of the *Pharmaceutical Journal*. As one who spent some months as a visiting worker in the pharmacological laboratories of the society, he came personally in contact with the varied activities of the society towards the organization of British pharmacy on a sound and nation-wide basis. Starting with a membership of about 800 in 1841, it has now nearly 25,000 members on its rolls, each of whom is now equipped by training and examination to offer professional service of a high standard to the medical profession and the public. Not many voluntary organizations in the world have such an inspiring account to put forward and the present authorities of the Pharma-

ceutical Society deserve the credit of being interested in pharmacy in the centennial edition of the journal which puts on record all the brilliant past achievements of the society, thereby serving to act not only as a constant source of inspiration for all pharmacists of the present generation but also for generations to come.

B. MUKERJI

### CENSUS OF ESSENTIAL DRUGS: NEW GOVERNMENT ORDER

WITH a view to maintaining a check on the import, manufacture and sale of essential drugs, a new order has been promulgated by the Central Government under the Defence of India Rules. The order is called the Essential Drugs (Census) Order, 1941, and is to come into force at once.

In accordance with this order, any person engaged in the business of manufacturing, importing or selling such drugs, whether wholesale or retail, is required to submit to the authority specified for his area, so as to reach that authority not later than the 27th day of each month, a return showing the quantity of any essential drug in his possession or under his control within British India on the 20th day of such month. No return, however, is required to be submitted if the total quantity of any essential drug in the possession or under the control of any person is less than that specified in the order.

Every manufacturer, importer or dealer in drugs, whether wholesale or retail, is required to keep a record of the purchase or sale of any quantity of an essential drug made by him, whether such quantity is less than that specified or not. No record of such transactions, however, need be kept by a retailer if the total quantity of an essential drug in his possession or under his control is less than that specified.

The correctness of any return submitted or record kept in pursuance of this order is subject to verification by any person authorized by the central or the provincial government for this purpose. The person so authorized will have the right to enter and inspect the premises of any manufacturer, importer or dealer and to inspect and take copies of any records, books or accounts kept in connection with such business.

The following are the authorities specified for receiving the returns in the various areas:—

Madras, the Central Provinces and Berar, and Coorg—the deputy assistant director-general (medical stores), Madras.

Bombay Presidency, Sind and Ajmer-Merwara—the deputy assistant director-general (medical stores), Bombay.

Bengal Presidency, Bihar, Orissa and Assam—the deputy assistant director-general (medical stores), Calcutta.

United Provinces, the Punjab, North-West Frontier Province and Baluchistan—the deputy assistant director-general (medical stores), Lahore.

### WAR STIMULUS TO MANUFACTURERS

TWO HUNDRED AND NINETY-TWO drugs and many items of other medical supplies formerly imported are now being manufactured by Indian drug manufacturers or Government medical depot factories. All these drugs have been transferred to the indigenous list.

Twenty-eight drugs are being produced in sufficient quantities for export. Orders have been placed for substantial amounts of the following drugs: amyl nitrite, atropine sulphate, boric acid, nikethamide, peptone, tetanus antitoxin, sodium tauroglycocholate and trichloroacetic acid.

Every drug for which the basic materials are available in India is now manufactured in India while many drugs are being manufactured from imported raw materials.

The surgical instrument industry has been fully mobilized and it is now possible to manufacture in India approximately 75 per cent of the army and civil

\*Published by the Pharmaceutical Society of Great Britain, 17, Bloomsbury Square, London.

requirements. The majority of the rubber articles used in hospitals are now manufactured in India.

The manufacture of sera required in the treatment of tetanus, diphtheria, anthrax, epidemic jaundice, etc., is developing and a promising beginning has been made, which should lead to India producing a large percentage of her requirements of sera, as she already does of vaccines.

An efficient substitute for cod-liver oil is now made on an extensive scale in India from the livers of sharks caught in Indian waters. The Government Medical Stores Department alone has purchased over 8,000 gallons of this oil. One of the leading woollen mills in India has agreed to supply a certain quantity of adeps lanæ and has, for this purpose, erected special plant for the recovery of wool-grease.

Another firm which manufactures chemicals is increasing its output of anæsthetic ether to 10,000 lb. per month. A Bengal firm is in process of erecting a large new pharmacy for the manufacture of galenicals and some special preparations. This firm is one of the world's largest manufacturers of strychnine and also specializes in the preparation of paris green for anti-malarial work.

Blood transfusion is largely used in modern medicine to combat shock through loss of blood. Such blood is difficult to obtain in quantity for the treatment of the wounded in the field and other methods are being carefully considered. One of the most successful and promising of these methods is the use of dried blood plasma. Blood to which sodium citrate has been added to prevent coagulation is allowed to settle and the clear liquid drained off. This liquid is dried *in vacuo* to a granular powder and packed aseptically in containers. Before use it is made into a solution with sterile water and given to the patient in the same manner as a blood transfusion.

The production of emetine hydrochloride required for the treatment of amebic dysentery is closely associated with the growth of ipecacuanha which grows wild in the forests of South America. It has also been proved to grow well in Mungpoo, Bengal, and the question of encouraging its cultivation in India is under consideration.

The manufacture of acriflavine, an important disinfectant particularly in war time, in India from locally produced materials is under investigation.

Troops in the field deprived of fresh vegetables or fruit develop scurvy. To prevent this disease, tablets of vitamin C are made up and India's most concentrated vitamin C is 'amla'. Amla berries are collected in the Nilgiris under the supervision of the director, Nutrition Laboratories, Coonoor, dried and made into tablets of suitable size.

Chloroform manufactured by a Bengal firm has been tested and found satisfactory. Sodium citrate is now being manufactured in small quantities by a firm in the Punjab from lemons grown locally.

Acids and other reagents of analytical purity are being extensively manufactured in India. Certain stains used for bacteriological work such as Congo red, eosin, methyl violet, etc., have been prepared from imported commercial dyes and are being purchased for the Medical Stores Department.

Distillation of essential oils has increased since the outbreak of the war and one firm has specialized in the manufacture of essential oils from indigenous raw materials such as lavender oil, lemon oil, etc.

Rubber goods, such as waterproof sheeting, hot-water bottles, air cushions of good quality, are now obtainable in India. Glass of many varieties and sufficiently pure chemically to be used as ampoules for biological products and in various designs for laboratory work is manufactured. There are two or three important glass manufacturers in Calcutta who make thermometers and glass-stoppered bottles. All kinds and sizes of bottles are being made, including stoppered bottles, by several firms in different parts of the country. Improvement has been found in the resilience of samples of rubber tubing manufactured by a Calcutta firm. A firm which produces waterproof sheeting for

the first-aid dressings and for hospital use, hot-water bottles, rubber corks and ice bags is erecting two extra mills for work for the Medical Stores Department.

A new and up-to-date factory for the manufacture of earthenware articles has been established and the Medical Stores Department have obtained large quantities of earthenware articles for hospital equipment from this source.

One of the biggest enamel works in India is being called upon to manufacture enamelware for the use of the Medical Stores Department.

Arrangements have been made by the Director-General, Indian Medical Service, for the production by private firms in India of 150,000 packets of 3 yards absorbent gauze. These packets were formerly made exclusively in Medical Store Depot factories.

Initial experiments made in sterilizing and amputing locally-made catgut for surgical purposes at a government institute, have been reported as satisfactory. It has therefore been decided to commence production on a small scale of plain sterilized surgical catgut of all sizes.

### ASSAM MEDICAL COUNCIL

AN Ordinary General Meeting of the Assam Medical Council was held on Monday the 12th May, 1941, in the office of the Inspector-General of Civil Hospitals, Assam, Shillong.

Among the subjects considered in detail by the council was the question of Government subsidy and it was decided that in view of the deficit budgets of the council Government should be approached again for the grant of a subsidy.

The Assam Medical Register was then scrutinized and after discussion it was resolved that the Assam Medical Register be amended by erasing from it the names of the practitioners known to be dead and of those practitioners whose whereabouts are unknown.

The council then considered the question of appointing a Standing Committee under Rule 28(1) of the Medical Council Rules, and resolved that a Standing Committee be constituted under Rule 28(1) of the Assam Medical Council Rules consisting of the President and two other members selected by the President from the members of the Assam Medical Council who are resident in Shillong at the time.

Among other matters discussed was the question of appointing a medical man as registrar of the council, raised by Dr. G. S. Das. On considering all the aspects of the proposition it was decided that a non-medical man with office experience and knowledge of administrative procedure was preferable for performing the registrar's duties.

The council then proceeded to consider a motion put forward by Dr. G. S. Das for revision of the procedure of the election so that the voting papers could reach the electors one month before the date of the election. On the understanding given by the President that steps will in future be taken to see how the procedure of the election can be speeded up, the motion was withdrawn by the proposer.

On a motion moved by Dr. G. S. Das it was unanimously resolved that the Government be requested to consult the Assam Medical Council when considering any re-organization of medical education or establishment of any new medical institution in the province.

Dr. G. S. Das then moved that in view of the recommendation of the Indian Medical Council the Assam Government be strongly moved to take immediate steps to raise the Berry-White Medical School to a college standard.

Dr. B. Bhattacharyya suggested an amendment which was disallowed by the President on the ground that the amendment was so worded that it could not be taken as an amendment but was altogether a different resolution.

Dr. M. S. Dutta proposed an amendment to the motion and suggested that for the words 'to raise the Berry-White Medical School to a college standard' the words 'to raise the medical schools to a college

standard' be substituted. This was also disallowed by the President on the grounds that it contemplated a hypothetical proposition and the council should confine itself to conditions as they existed.

The motion was then put to the vote and was carried by a majority, two members voting against, and the rest voting for, it. The members voting against it gave a notice of submitting a minute of dissent.

Dr. G. S. Das moved the following motion:—

That the Inspector-General of Civil Hospitals, Assam, be requested to issue a circular to all medical officers serving under him asking them to refrain from granting testimonials to manufacturing concerns.

The motion was withdrawn by the mover when the President referred to the provision in the Code of Medical Ethics II-I(f) which debar all medical officers from granting testimonials to manufacturing concerns.

## THE 18TH ALL-INDIA MEDICAL CONFERENCE

The 18th All-India Medical Conference is to be held at Hyderabad Deccan in the last week of December 1941—the dates provisionally fixed are the 26th, 27th and 28th of December 1941.

There will be three sections—(1) medicine, (2) surgery, and (3) midwifery and gynaecology.

There will also be an exhibition in two sections:—(1) scientific and (2) medical and surgical appliances, pharmaceutical preparations, etc. Visits to places of interest and socials are also being arranged.

Members of the medical profession are invited to contribute to the success of the conference by taking part in its deliberations.

## INDIAN MEDICAL COUNCIL

In exercise of the power conferred by clause (a) of sub-section (1) of section (3) of the Indian Medical Council Act, 1933, the Central Government is pleased to nominate the following persons as members of the Medical Council of India, with effect from 29th September, 1941:—

1. Colonel W. C. Spackman, M.B., B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), F.R.C.S. (Edin.), F.R.C.O.G. (Lond.), I.M.S., Inspector-General of Civil Hospitals, Bihar (from Bihar).

2. Lieutenant-Colonel J. P. Huban, O.B.E., M.B., B.Ch. (N. U. I.), I.M.S., Inspector-General of Civil Hospitals and Prisons, North-West Frontier Province (from North-West Frontier Province).

3. Colonel A. C. Macrae, M.B., Ch.B. (Aberd.), D.M.R.E. (Camb.), I.M.S., *vice* Brevet-Colonel A. MacD. Dick, C.B.E., M.B., Ch.B. (Edin.), L.R.C.P. (Lond.), F.R.C.S., I.M.S., vacated, 30th July, 1941.

In exercise of the power conferred by clause (a) of sub-section (1) of section (3) of the Indian Medical Council Act, 1933 (XXVII of 1933), the Central Government is pleased to nominate Colonel W. C. Paton, M.C., M.A., M.B., Ch.B. (Edin.), F.R.C.S. (Edin.), I.M.S., Surgeon-General with the Government of Bengal, to be a member of the Medical Council of India, from Bengal, with effect from the 29th August, 1941, *vice* Major-General P. S. Mills, I.M.S., resigned.

## ECONOMY IN THE USE OF DRUGS IN WAR TIME: MEDICAL RESEARCH COUNCIL: THERAPEUTIC REQUIREMENTS COMMITTEE

### TABLE IV

*Identical substitutes of British manufacture  
(Published on page 554 of the September issue)*

### ADDENDA

**CARDIAZOL**—All the cardiazol preparations (penta-methylenetetrazol), formerly manufactured in Germany, have now been manufactured in England for a very long time, by Knoll Limited of London. The name

'Cardiazol' is still used in England, but in India the name has been changed to 'Cartazol'.

**DORYL**—This was formerly manufactured by E. Merck, of Darmstadt, but also for a very long time has been manufactured in England by Savory and Moore, Limited, of London. It is obtainable under the name 'Moryl'.

Both these British preparations are available in this country.

## THE FACULTY OF TROPICAL MEDICINE AND HYGIENE, BENGAL

The following students are declared to have passed the L.T.M. Examination, Session 1941.

### *Passed with Distinction*

1. Jai Dev Raj Kohli, L.S.M.F., private practitioner.

### *Passed*

(Arranged in alphabetical order)

2. Dilip Kumar Banerjee, L.M.F., private practitioner.
3. Kalyan Kumar Banerjee, L.M.F., private practitioner.
4. Sailendra Mohan Bhattacharjee, L.M.F., assistant medical officer, Jainti Tea Estate, Jalpaiguri.
5. Sailendra Mohan Chakrabarty, L.M.F., private practitioner.
6. Tarak Nath Chakraburttty, L.M.F., private practitioner.
7. Jitendra Kumar Chakravorty, L.M.F., temporary doctor on epidemic duty, Public Health Department, Bengal.
8. Nirmal Kumar Chaudhuri, L.M.F., private practitioner.
9. Vishvambhar Harishankar Dave, L.M.F., private practitioner.
10. Shombhu Nath Dey, L.M.F., private practitioner.
11. Usha Ranjan Dey, L.M.P., assistant medical officer, Mokalbari Tea Estate, Assam.
12. Sudhindra Kumar Dhar, L.M.F., private practitioner.
13. Satyabrata Dutt, L.M.F., private practitioner.
14. Tanjore Sundaram Ekambaram, L.M.P., sub-assistant surgeon, Government of Mysore.
15. Krishna Narayan Ghose, L.M.F., private practitioner.
16. Jatindra Nath Ghosh, L.M.F., private practitioner.
17. Promode Chandra Ghosh, L.M.F., private practitioner.
18. Santi Priya Ghosh, L.M.F., private practitioner.
19. Tejendra Nath Guha Ray, L.M.F., garden doctor, Mathura Tea Estate, Jalpaiguri.
20. Amulya Charan Haolader, L.M.F., private practitioner.
21. Harbans Singh, L.S.M.F., private practitioner.
22. Krishen Sarup, L.S.M.F., private practitioner.
23. Govindas Gangadas Lad, L.M.P., assistant medical officer, Central Provinces Government.
24. Jagdish Chandra Mahyer, L.M.F., private practitioner.
25. Abani Mohan Nandy, L.M.F., house surgeon, S. K. Hospital, Mymensingh.
26. Balkrishna Wasudeo Parasnis, L.C.P.S., private practitioner.
27. Balbantrai Hirachand Parekh, L.C.P.S., private practitioner.
28. Kantilal Haribhai Patel, L.C.P.S., private practitioner.
29. Ratilal Chhaganbhai Patel, L.C.P.S., private practitioner.
30. Vithalbhai Jhaverbhai Patel, L.C.P.S., private practitioner.
31. Ram Singh, L.S.M.F., private practitioner.
32. Kadaba Yajman Ramaswamy, L.M.F., private practitioner.
33. Dharam Vir Saigal, L.S.M.F., private practitioner.
34. Tarunaswar Sarma, L.M.P., private practitioner.
35. Birendra Nath Sircar, L.M.F., private practitioner.

## Public Health Section

## RURAL MALARIA

Of the many factors that have contributed towards the decline in the health of the people of rural India, malaria is probably the most important. Despite the brilliant discoveries regarding the mode of transmission, and the treatment and control of the disease, malaria continues to cause an enormous amount of ill health and to collect a heavy toll of human lives every year. It has been estimated that as many as 200 million people suffer from malaria in this country and that 2 million people die as a direct or indirect result of this disease. The economic loss to the country attributable to the disease has been estimated by several eminent authorities as being well over 50 crores of rupees per annum. It is therefore justifiably considered to be the most important of India's public-health problems.

The public-health departments in all the provinces of India are devoting much of their time, money, and energy to lessening the morbidity and mortality caused by malaria. The various weapons available for fighting this scourge are being tried and the achievement, though marked, is not as satisfactory as it might be. Many reasons have been given to explain why malaria still continues to be a major problem. To discuss these is not the purpose of this article; suffice it to say that among them all one reason stands out which is easy to remedy. This is the apathy of the villager to any problems affecting his own health.

The average villager lacks the enthusiasm for social improvement and is seldom willing to co-operate with his fellow villagers for a common cause. This is particularly unfortunate because malaria is one of those diseases which the villager can do a very great deal towards controlling through a communal effort.

The Public Health Commissioner in his report for 1938 says :—

'The necessity for securing the interest and co-operation of the people in measures designed for their own welfare demands that they should be encouraged to participate in the execution of such measures. It was the custom in India for villagers to carry out certain duties without any remuneration. Free labour was their contribution for communal works. If this custom could be revived, or introduced where it does not exist, the amenities of village life could be vastly improved; for, the villager himself is unable to pay for hired labour and it is hardly likely that the Government can fully provide either the men or the finance for such works.'

This indicates that the real salvation of the rural population of India lies not in sitting quiet and praying to the *Sircar* to provide this, that, and the other amenities, but in girding up their loins and striving to improve themselves. The lethargy and indifference must be shaken

(Concluded at foot of next column).

## SOME SOCIAL OBSTACLES TO MALARIA CONTROL\*

By PAUL F. RUSSELL

## Introduction

THERE was a time when the question, 'Why malaria?' was answered simply by saying,

\*This paper is one of a series arising from Malaria Investigations, a research project under the auspices and with the support of the International Health Division of the Rockefeller Foundation co-operating with the Health Department of Madras Presidency and the Pasteur Institute of Southern India in Coonoor.

(Continued from previous column)

off; the ignorance and superstition must be dispelled; a strong desire to live like their brethren in other countries must be born; and the requisite enthusiasm and energy to help themselves must be built up. Social workers must be found in every village with a genuine love for the people and an undying desire for service and sacrifice. They must educate and unify the people, awaken their dormant sanitary conscience, and make them contribute in terms of community labour if not in money, and effect through the medium of self-help societies whatever improvements are possible for ridding the villages of malaria.

If that is the position to-day, the question naturally arises as to how this change in the outlook of the villager is to be brought about. In this vital matter of rural health every official and every educated individual in the country should play his or her part, but a very special responsibility devolves on the public health departments who are the legal custodians of the health of the people. They can do much in the way of organizing the village self-help societies, providing them with practicable technical measures, and giving frequent technical supervision over the carrying out of these measures.

Malaria is only one of the many ills from which the poor Indian villager suffers, but it is by far the worst in sapping his vitality insidiously until his physique is damaged beyond repair. With the political awakening of the people of India and the introduction of responsible self-government in the provinces, it is encouraging to note that in some places genuine attempts are being made to revive in the villager his old love for his village and to obtain his willing co-operation and help in all measures directed towards the improvement of his environment in general and the eradication of malaria in particular. Let us hope that the villager will respond to the call and contribute his share towards the achievement of the common goal.

'Bad air !' Then, following Ross, at the turn of the century, came the aphorism, 'No mosquitoes, no malaria !' This satisfying but deceptive slogan was soon paralleled by the equally accurate and misleading, 'No gametocytes, no malaria !' Such men as Koch saw in widespread distribution of cinchona derivatives, a relatively quick and sure method of eradicating this disease. Then there was progress through the stage of 'No *Anopheles*, no malaria !' to modern species sanitation on the basis of 'No vectors, no malaria !' There have been devised potent weapons, such as screening, larvicidal oils, Paris green, pyrethrum sprays, drainage, and water-manipulation. The blunderbuss has been stream-lined. But malaria persists, of all diseases of mankind to-day, the most effective destroyer of health, happiness, and prosperity.

This paradox seems understandable only when one steps out of the laboratory to examine social aspects of malariology. Why is malaria control still a relatively feeble effort ? Is it lack of laboratory and field knowledge, of tools, of means ? Or is the social organization unable to apply effectively the money, potential labour, control weapons, and research findings ? Is it not time for scientists, whatever their specialty, to ponder what Bernal (1939) calls *the social function of science* ?

The purpose of this paper, however, is not to enter into an abstract consideration of the social implications of malariology but rather to consider, as practically as possible, one phase of the subject, namely, *social obstacles to malaria control*.

### *Why malaria ?*

The question 'Why malaria ?' seems to be answered to a considerable extent by the fact that in many parts of the malarious world to-day there are five fundamental lacunæ which must be filled before one may reasonably expect much further reduction in prevalence of the disease. These social causes for the maintenance of malaria appear to be as follows :—

#### *Some social reasons for perpetuation of malaria as a public-health problem*

1. Absence of a sufficient weight of public opinion which has been enlightened regarding (a) economic and public-health importance of malaria; (b) available measures of malaria prophylaxis and control; (c) social responsibility for prevention of malaria.

2. Lack of sound administrative principles, especially as regards (a) co-ordination of, and effective distinction between, hygiene and preventive care, on the one hand, and preventive medicine and medical-surgical care, on the other; (b) methods of obtaining effective co-operation between such governmental departments as public works, agriculture and public health; (c) necessity for continuity of effort when dealing with malaria.

3. Lack of adequate training of health officers in practical malaria control methods and lack of sufficient numbers of specialist personnel, such as malariologists, malaria entomologists, engineers, and agronomists.

4. Lack of official cognizance of economic considerations as to (a) what malaria actually costs a community; (b) what benefits the control of malaria would confer on a community; (c) what constitutes a proper budget item for malaria control.

5. Inadequate knowledge of methods for applying practically, that is effectively and economically, the results of research in malariology.

These points may be considered in more detail.

*I. Absence of a sufficient weight of public opinion which has been enlightened regarding (a) economic and public-health importance of malaria; (b) available measures of malaria prophylaxis and control; (c) social responsibility for prevention of malaria.*

Many a man's whole concept of disease prophylaxis may be summed up in the words, 'God bless my heart, liver, and lungs'. Malaria control to average laymen, and indeed, to lay administrators, is simply the pouring of oil or of quinine pills from bottles. Schools teaching history but not hygiene, training colleges too busy with pedagogy to consider public health are common anachronisms. One sees a textbook on political science held against the bulge of a malarial spleen and one hears of social achievements of an ancient civilization from lips blanched by malarial anæmia. Advertisements of quack doctors and patent medicines constitute 'home study in health education' for multitudes. Yet, without sufficient health-knowledge among laymen, personal and community hygiene is impossible, necessary appropriations for public health measures are not voted, salutary laws are not made or obeyed, sanitary progress is delayed. In the absence of totalitarian methods, an educated community opinion about public health is essential to the conquest of such preventable diseases as malaria.

Two types of general health education are required (see Hydrick, 1937). In the first place, there is *Student Training* in principles and practice of personal and community hygiene. This teaching must permeate the curricula of all schools from lowest grades through technical colleges and universities, and must be intensely practical. Secondly, there is *Health Propaganda* designed chiefly for adults and most successful if they have had previous instruction as students. This propaganda must be accurate, simple and, above all, *practical*. The combined effect of student training and health propaganda should be to develop an intelligent and articulate desire for such changes in habits and environment as are necessary to prevent disease; and a willingness to pay, in effort or money, for



these changes. How long would a community remain malarious if a majority of its population had a *practical* understanding of what malaria cost them, of why it existed, of what measures were available to control it? Health education must impart significant information, must arouse both interest and desire, and must lead to effective *practical* action.

Schools, colleges, and universities must expound not only general principles of malaria control, to develop a basic appreciation of local conditions and problems, but they should also attempt to create in students, (a) sound economic ideas regarding the impact of malaria on a community; (b) a scientific rather than folklore understanding of malaria prophylaxis; (c) social concepts of the responsibilities of good citizenship as regards disease prevention in general and malaria control in particular.

Students must learn that *the protection and conservation of life is a major social function*. Education must be much more closely related to the actualities of everyday life. Simple reiteration of the fact that malaria is a mosquito-borne disease does not meet modern requirements.

By way of example, consider India. Sinton (1936), than whom no one is better qualified to comment, states that in this country malaria in ordinary years directly kills at least one million persons a year and indirectly is almost certainly responsible for another one million deaths. There are at least one hundred million cases of malaria each year in India. Further, Sinton states that financial losses from malaria to the individual and the family in India annually amount to not less than eighty million pounds sterling. This financial loss is apart from effects of the disease upon all aspects of the labour problem. Sinton concludes that malaria gives rise to the greatest economic problem with which India is faced. Quoting 'the problem of existence in very many parts of India is the problem of malaria. There is no aspect of life in this country which is not affected, either directly or indirectly, by this disease. It constitutes one of the most important causes of economic misfortune, engendering poverty, diminishing the quantity and the quality of the food supply, lowering the physical and intellectual standard of the nation, and hampering increased prosperity and economic progress in every way'.

Malaria is usually not a dramatic affliction like cholera, plague, or smallpox. It is an insidious, anaemia-producing, ambition-destroying enemy. The average individual in India, if he ever thinks of it at all, views malaria with resignation, without the faintest realization of how it has retarded the development of his country. He has not the slightest conception of the fact that, over and over again, it has been conclusively demonstrated that malaria prophylaxis is not only feasible but is economically profitable in many areas. Finally, as a rule,

he has not the remotest feeling of social responsibility for the control of this disease. There is little urge to contribute either money or labour, in fact even co-operation is often unobtainable. One rarely finds, anywhere in India, an educated, articulate, and effective public opinion regarding malaria and its prevention. Absence of this primary mainspring for effective control programmes constitutes one of the chief reasons why malaria continues to ravage the countryside, practically unchecked.

II. *Lack of sound administrative principles, especially as regards, (a) co-ordination of, and effective distinction between, hygiene and preventive care, on the one hand, and preventive medicine and medical-surgical care, on the other; (b) methods of obtaining effective co-operation between such governmental departments as public works, agriculture and public health; (c) necessity for continuity of effort when dealing with malaria.*

(a) There is no doubt logically that basic principles of prevention must permeate all private and official practice of medicine,—and to a much greater extent than before. In this sense there can be no separation between prevention and cure in medicine.

But, important as it is that all medical work should be imbued with modern ideas of disease prevention and maintenance of public health, it appears to some observers that in practice there must be an administrative separation at the periphery between (a) hygiene and preventive care on the one hand and (b) preventive medicine and medical-surgical care on the other.

Following, in general, Hydrick's (1938) definitions, *Hygiene* means protective care of the body, largely a personal matter, stimulated by adequate instruction from parents, teachers and health workers. As regards malaria, hygiene includes such personal precautions as the use of screening and bed-nets. *Preventive care* is the social utilization of scientific knowledge to prevent disease and to maintain health through organized community effort. It attempts by technical, chemical, naturalistic, or other methods, to prevent unhygienic factors and the causative agents of disease from coming in contact with the body. It is chiefly a communal, rather than a personal, matter. Preventive care may be divided into, (a) technical preventive procedures and (b) epidemiology. In the cases of malaria, *technical preventive procedures* range all the way from spray-killing adult mosquitoes to extensive drainage schemes, which eliminate mosquito breeding. *Epidemiology*, in a broad sense, includes such matters as investigation of endemic and epidemic malaria; development of statistical and registration services; isolation and quarantine; use of proper laws and regulations.

*Preventive medicine* is a medical rather than a hygienic social service, for it deals with medication by vaccines, sera, and drugs. It is



preventive in the sense that by mass treatments it tends to reduce suffering and death, and, in some cases, to prevent the spread of disease. *Preventive medicine* includes such procedures as the mass treatment of malarious peoples. Another branch of medical service is that of *community medical-surgical care*, which includes the treatment of individuals in public hospitals and dispensaries, or at home, by public medical officers.

There is no doubt that malaria control in some localities has been hindered by a confused combining of preventive care and preventive medicine in what should be a strictly hygienic agency. Over and over again during the past 40 years, it has been demonstrated that malaria cannot be controlled in practice by mass distribution of such therapeutic drugs as have been available. No fact in malariology has had more convincing proof than this. Malaria cannot be prevented by a system of dispensaries or dispensing agents, however well organized. No one questions the value of malaria treatment or the need for a much wider use of anti-malaria drugs. But there is no evidence that this phase of malariology constitutes control. It is *medical* and not *hygienic* service. There is need for administrative reform which will provide adequate treatment for the malarious sick but will prevent those whose primary concern should be *preventive care* from devoting their energies to the field of preventive medicine.

As regards details of an effective administrative set-up for malaria control, there will be wide variation since local conditions differ greatly from country to country. As a matter of fact, considerable research is required to determine what constitutes the best type of organization for this specialty. Some administrators prefer to have all malaria control done by regular health officers as a part of their routine duties, others prefer to have a special division of malaria control. It is not possible to say which is the better plan until there have been sound studies in this problem of administration. At any rate, as will be noted under section III below, specially trained officers are essential.

The Inter-governmental Conference of Far Eastern Countries on Rural Hygiene (1937), convened by the Health Organization of the League of Nations, made the following suggestions as regards administrative policy in malaria control: 'The Conference, secondly, recommends that since malaria is a focal disease in any country—absent in some rural areas, lightly prevalent in others, and moderately or heavily endemic elsewhere—the structure of, and programme for, rural health organization, including health units and health centres, should not be stereotyped, but flexible. In those areas where malaria is the outstanding social and health problem, the resources of the health administration, especially augmented where necessary,

should be directed chiefly towards malaria control, even if this should entail the restriction of other public health activities, until malaria is no longer of major importance. As a rule, the physical debility and mental apathy of malaria-stricken people will not permit them to respond to a general public-health programme, so that it is a logical procedure first to deal with malaria. On the other hand, where malaria is of minor importance, it may be dealt with adequately as a part of an ordinary health programme'.

Thirdly, the Conference would like to emphasize the value of practical demonstrations of malaria control as a means of arousing the interest of lay (and even health) administrators. The lack of a good example of malaria control, well documented as regards statistics and costs, often explains official apathy and failure to appropriate funds for control programme. The Conference recommends that, in countries where malaria control programme is poorly developed or is being projected for the first time, sufficient funds be allocated for at least five years, to carry out a model project. This should include, not only the controlled area, but also an equally carefully-studied area nearby in which no control is carried out, so that a contrast may be available. Such a demonstration control project with its contrast area has very great propaganda value, much more than a score of surveys barren of practical results'.

Sound administrative principles in democratic countries require an appreciation of the twin virtues of self-government and self-support. There must be standards of objective and of technique in malaria control, with a practical degree of uniformity of procedure. Projects should be feasible and beneficial, based on ample legal support, and having strict regard for public economy.

One cannot, as a rule, logically plan elaborate and expensive control programmes for rural communities any more than one can give such areas piped water supplies or complex sewage disposal systems. Yet country districts need not be burdened with malaria any more than with bowel diseases. Cheap methods for providing safe water and sanitary disposal of body wastes are available. They are not so perfect as one has a right to expect in municipalities but they meet the needs. So too, in dealing with malaria, there must be a recognition of the difference between urban and rural control. In the latter, one must rely usually on cheaper and less perfect measures, although there are places where extensive rural drainage projects to combat malaria are both feasible and economically sound. When such projects are designed to make better cultivation of crops possible, the results may greatly enhance the economic welfare of a community.

Generally, for cities one can recommend cash-purchase of malaria control, whereas country towns should be encouraged to rely on self-help to a greater extent. For populous

municipalities time frequently has considerable economic importance. Malaria control can often be obtained rather quickly by paying for speed. In the rural tropics, time has far less importance than money. Cheapness, not speed, is essential. Further, as noted below, persistence, not perfection, should be the motto. Central Governments can put up supervision and sometimes materials if a local community will provide labour. Participation by individual citizens is far more important in rural malaria control than in urban programmes.

(b) There has been a notorious lack of co-operation, as regards malaria, between departments of public works, agriculture and public health. By way of illustration irrigation malaria may be cited (*see* Russell, 1938). This has been subject to investigation by health officers for almost a hundred years but is probably a greater nuisance now than ever before. Waste irrigation water is an agreeable sight only to an entomologist who collects mosquitoes. To the irrigation engineer it represents spoilage of a valuable commodity, to the agronomist it offers another reason for high rates and water-logged soil, and to the health officer it is frequently known as a source of malaria-carrying mosquitoes. Yet, in spite of this and numerous other aspects of irrigation clearly calling for co-operation, even to-day projects are being planned and opened which are certain to distribute malaria as well as water, because of a fatal lack of co-ordination between the three departments of public works, agriculture, and public health. There is urgent need for more frequent, more active, and more practical co-operation between malariologists and irrigation engineers, before, while, and after an irrigation project is undertaken in any area potentially or actually malarious.

An appalling amount of malaria is generated by human beings, who should know better, in such situations as (i) defective and untidy irrigation systems; (ii) engineer-sponsored borrow pits, embankments, and faulty culverts; (iii) town and village ditches; (iv) excavated depressions, and ill-kept tanks; (v) uncontrolled jungle clearance; (vi) improper siting, housing, and labour control during dam, canal, hydro-electric, bridge, road and railway construction, and (vii) in forest cuttings. Most of this 'official' man-made malaria could be avoided by intelligent co-operation between various government departments and the health administration.

The Intergovernmental Conference, referred to in a preceding section, reported as follows: 'In the fourth place, the Conference emphasizes the vital need for administrative co-operation between the health and other government departments, such as agriculture, education, finance, forestry, irrigation, and public works. Further, the Conference recommends that, in the development of rural malaria control, the aid of such local bodies as co-operative societies,

health leagues, and rural improvement centres should be enlisted and utilized to the fullest possible extent'.

Again quoting from this report, 'the Conference recommends, first, that every effort be made by lay administrators to secure close co-operation between their engineers and health officers, secondly, that appropriate legislation be enacted to prevent the creation of malariogenic nuisances by engineering departments or contractors under their supervision; thirdly, that, in the budget of every constructional project in malarious places there be an item for malaria control; and, fourthly, that engineers be instructed in the fundamental principles of anti-malaria sanitation before assuming executive responsibilities in the tropics. In the opinion of the Conference, this end would be best achieved by special pre- and post-graduate courses of instruction and by suitable pamphlets for subsequent guidance'.

In this connection, it is of interest to note that at the Eastern Bureau of the Health Organization of the League of Nations in Singapore and also at the Malaria Institute of India in Delhi, malaria courses for engineers have recently been organized. These have been well attended and have been enthusiastically supported by engineers.

(c) When dealing with malaria there is a vital need for continuity of effort. All too often malaria control consists of spasmodic 'campaigns', the net result of which may be almost or completely *nil*. It has not been sufficiently understood that there is as much need for continuing malaria control from year to year as there is for carrying out other public services without interruption. One does not expect that having repaired the roads this year they will require no further maintenance. So, too, the control of malaria, unless endemicity is very weak, is a never-ending procedure, like the sterilizing of water. Certain substantial works will lessen the amount of recurring effort required but will not obviate the need for an annual item in the budget. Good and thorough as was malaria control in the Panama Canal Zone during the construction period, yet year by year the work still goes on, as incessantly as maintenance of the canal itself.

It sometimes happens, as in Bombay, that when control measures have brought malaria mortality and morbidity rates down to low figures, lay officials will say, 'why a malaria appropriation when we have no malaria?' They fail to realize that it would be equally illogical to say, 'why, since our drinking water was chlorinated last year with good results, should we vote any further money for its sterilization?'

In any area where malaria is more than faintly endemic the chances of securing really permanent control from an 'extra' budget item, granted for a year or two, are slight. Officials must accept the fact that there will have to be routine

annual items for malaria control in the budget during this and perhaps several generations.

Co-operative lay organizations for malaria control have rarely been capable of the necessary *sustained effort*, chiefly because of (i) the lacuna listed under section I above; (ii) lack of adequate technical supervision; and (iii) failure of *sustained official encouragement and support*.

Persistence is far more important than either speed or perfection in malaria control. A modest programme *continuously applied*, year after year, is less dramatic but very much more effective, and *more economical*, than an occasional period of feverish endeavour followed by inactivity. This sound administrative principle has been demonstrated repeatedly but is still not grasped by the average administrator.

*III. Lack of adequate training of health officers in practical malaria control methods and lack of sufficient numbers of specialist personnel, such as malariologists, malaria entomologists, engineers, and agronomists.*

The day of the amateur lay or official malariologist has passed. The average general health officer or sanitary inspector is *not* qualified to carry out malaria control measures until he has had specialized training in this highly technical field. Effective malaria control, on any but the smallest backyard scale, requires specially qualified personnel, who may or may not constitute a separate division in the Health Department.

The Inter-governmental Conference, mentioned above, reported as follows: 'The Conference, in the first place, considers that the technical assistance of staff specially trained in malaria work is absolutely essential if an administrator is to deal successfully with malaria control. This consideration follows the general lines suggested by the League of Nations Malaria Commission as far back as 1924. Any malarious country which to-day has no health personnel skilled in malaria technique must be regarded as an anachronism. But the Conference believes that responsibility for malaria control should rest squarely on the minister or other officer in charge of the health policy of a country and not on the technical expert'.

It would appear that Governments, such as Presidencies and States, within whose territory malaria constitutes a public health problem, logically could include among their officers the following:—

1. A health officer specially trained in methods of malaria control, or better still, a professional malariologist, who should also have had general public-health training.

2. A sanitary engineer specially trained in methods of malaria control, or better still, a professional malaria engineer, who should also have knowledge of general sanitary procedure and of agricultural engineering. If it is not feasible to employ either a general sanitary or a malaria engineer, there should at least be health inspectors or overseers available who have a sound

knowledge of running levels and constructing drains. When dealing with irrigation malaria, skilled technical advice is essential. Every Public Works Department or Irrigation Department in malarious areas should see to it that at least one of their regular staff has had special training in malaria control.

3. A medical entomologist is essential to a Department of Public Health not only in connection with malaria problems but to assist in planning the control of other insect-borne disease.

4. A malaria agronomist, whose time and skilled attention could be devoted to ways of avoiding that all-too-prevalent, man-made malaria directly due to agricultural methods or lack of them. If such a specialist is not available, efforts should be made (a) to impress those health officers dealing with malaria with the importance of anti-malaria drainage in reference to agriculture; (b) to obtain some realization on the part of farm demonstrators of the close association between agronomy and malaria and the agricultural benefits to be derived from rural malaria control.

Such a staff, augmented by a sufficient number of trained field inspectors and laboratory assistants, would seem to constitute a minimum requirement, especially at the beginning of a malaria control programme. Certainly, size of malaria staff should have positive correlation with magnitude of malaria problem. This staff can make surveys, recommendations, and demonstrations of malaria control. It may have either advisory or executive functions or both, depending on the administrative plan found most practical for a given area.

One reason why there are a hundred million cases of malaria yearly in India is the fact that the numbers of personnel specially trained for malaria control are so few.

*IV. Lack of official cognizance of economic considerations as to (a) what malaria actually costs a community; (b) what benefits the control of malaria would confer on a community; (c) what constitutes a proper budget item for malaria control.*

All too often it is stated officially that no money is available for malaria control. Not until public officials become convinced that malaria control is a good investment will they budget adequate amounts of money to accomplish it. Many more malario-economic surveys are required to convince lay administrators of the fact that malaria as a rule, even in rural areas, costs a community more actual cash-money, year by year, than would be required for its control.

For example, in a recent survey of a strictly rural South Indian village (Russell and Menon, 1941) it was found that the *per capita* annual payments for the treatment of malarial fevers by quacks, priests, and doctors were Rs. 2-8-0. Losses due to money paid out and to cash wages not received because of malaria amounted to

Rs. 3-14-0 *per capita* per annum. In this village malaria can certainly be controlled by spray-killing adult anophelines for less than Rs. 0-8-0 *per capita* per annum (Russell and Knipe, 1941). There are few villages in India on a much lower economic level than this one, where the total *per capita* annual income was only Rs. 35-3-0. Yet, viewed simply as a matter of rupees and annas, malaria control here would be a good investment.

However, the people in this village are undoubtedly too poor themselves to make a cash investment in malaria control. They will have to endure their affliction until there exists official cognizance of the economic aspects of the situation and both an official and a local sense of social responsibility for malaria prevention. To call upon these people to put up money for malaria control is as ignorantly unreasonable as was Marie Antoinette's suggestion to the people of Paris: 'If you have no bread, why don't you eat cake?' But, as in most rural, tropical villages, there is a surfeit of unemployed labour which is potentially available.

Quoting Hoffman (1928), statistician of the Prudential Life Insurance Company, 'the cause of malaria eradication rests upon sound economic as well as self-evident humane considerations, leaving no escape from the final conclusion that the entire subject most urgently demands the qualified and intelligent co-ordination of all existing governmental agencies and related health-conserving activities, on the one hand, and a broad-minded public policy, on the other, with special reference, however, to the expenditures on behalf of local anti-malarial measures on the part of the general public. For economic reasons alone the effort would be worth while, since the economic results of effective anti-malarial measures are a foregone conclusion'.

What would constitute a proper budget item for malaria control in one area might be out of proportion in another. Governments must budget in accordance with the size of their problems, realizing that it is doubtful if they can make a better investment than that in malaria control.

There are many examples that prove that, for constructional projects in malarious places, an item in the budget for malaria control of less than 3 per cent of the total cost of the project will be found to be an excellent investment.

*V. Inadequate knowledge of methods for applying practically, that is effectively and economically, the results of research in malariology.*

Undoubtedly, more research is required to devise cheaper measures of malaria prevention in rural areas, where, as a rule, *per capita* costs of available methods are two or more times the probable maximum *per capita* funds which could be raised locally for malaria control. For example, in South India, malaria control in rural areas probably cannot be done by any method known to be effective for much less than five to eight annas *per capita* per annum, including the

cost of paid labour, while it is a consensus of opinion that two annas *per capita* per annum would be a maximum amount which could be obtained from local or government funds for malaria prophylaxis. Even this amount would be difficult to find, no matter how much one stressed the fact that malaria itself was costing several times this sum. Not until rural malaria can be controlled more cheaply, will rapid progress be made, and here is a promising field for research, especially in naturalistic and agricultural measures of mosquito control, such as shading, pollution, and intermittent irrigation (the 'turn system').

But more research is by no means the complete answer. For example, the abundance of potential labour, which might be contributed on a co-operative basis, and the availability of potent weapons have been mentioned. One might also point out that it has certainly not been lack of funds or equipment that has delayed the control of malaria in the southern United States. The difficulty there as elsewhere is explained by the four lacunæ already mentioned, together with the absence of suitable methods for applying promptly and effectively the results of research in malariology, long available to public-health administrations. Governments, as a rule, are not only slow to budget money for malaria research but are loath to try out newer methods as they come from laboratory or field research units. There is need for more use of 'testing grounds', more willingness to budget money for demonstration projects and trial programmes.

### Discussion

Bernal (1939, p. 383) reflects upon the function of science in relation to society. His remarks, appertaining to science in general, seem applicable directly to malariology. Quoting: 'How can all mankind best be maintained at a level of bodily efficiency and well-being, and how can we, once that minimum has been reached, secure the greatest possibilities for social and intellectual development? These are the crucial problems of our time. To solve them requires, in the first place, a wide extension of the field of science. No amount of physical or biological knowledge will suffice. The obstacles to the solution of the problem are not any longer mainly physical or biological obstacles; they are social obstacles. To cope with social obstacles it is first necessary to understand society. But society cannot be understood scientifically without at the same time changing it. The academic social sciences of the present day are useless for such a purpose; they need expansion and transformation. The science of society must grow up in contact with the social forces which are moulding it'.

This quotation should not be used to suggest that malaria is a sociological rather than a sanitary problem in any but the widest sense. For instance, there is no sound evidence that

famine and malnutrition are direct etiological factors in malaria, in fact such experiments as have been done indicate that a well-nourished individual is fully as susceptible to plasmodia as one who is mal-nourished. Passmore and Sommerville, 1940). Witness how readily well-nourished, physically superb troops go down with malaria when unprotected from the vector mosquito. The presence of famine conditions may cause malarious individuals to attempt to work before they are fit, increasing the relapse rate, or they may tend to drive families into other areas which are thus seeded with gametocyte carriers. But basically, what Hackett (1937, p. 15) calls the American Thesis, that malaria is a simple function of anopheline vector density, has never been upset and must be kept in mind. Any measure that directly attacks the plasmodium, or that tends to destroy the anopheline vector, to lower its density, or to keep it from man, may have prophylactic value. Without one or more of these characters, a method cannot be classed as malaria control. 'Good housing', for example, has no malaria control value unless it includes screening and proper siting with reference to malaria vectors. The provision of proper food and shelter is, of course, an important social health service but there is no proof that one can control malaria by increasing the food supply or supplying better-ventilated homes.

True it is that malaria sometimes maintains its greatest prevalence in areas of lowest economic status. This may be due, for example, to poorer drainage of cheaper lands. The evidence goes to prove not that poverty is responsible for malaria but that malaria frequently maintains poverty. It is a very difficult task to raise anæmic, malaria-beaten individuals to a plane of greater agricultural or industrial activity by any amount of political afflatus or social service. But it is surprisingly easy to stimulate a community which has been lifted up from the sloughs of chronic paludism by anti-mosquito measures.

It seems clear that as regards the immediate technique of malaria control one must not fail to make direct attacks on the plasmodium and especially on the insect vector. Attempts to control malaria by supplying routine social service or more opportunity for industrial and agricultural activity are apt to be futile.

However, in a wide sense it is quite true, as Bernal suggests, that the obstacles in the way of malaria control to-day are no longer mainly technical or biological, they are chiefly *social*. It would be useful if cheaper methods of malaria control were available for rural areas and one would certainly not suggest that no further research in technical or biological phases of malariology is required. But it is true that the basic ætiology of malaria has been known for over 40 years and that there are mechanical, chemical, and naturalistic weapons available to combat the disease. Science has perfected these

weapons so that they are readily available, remarkably effective, and reasonably economical.

Why then does malaria kill, directly or indirectly, over two millions of persons a year in India? Why to-day, throughout the tropics and sub-tropics, does malaria, to a greater extent than any other single factor, tend to lower and to keep down the level of bodily efficiency and well-being?

The answer seems to lie primarily in such *social obstacles* as have been discussed above. These are (1) a fundamental absence of educated and effective public opinion; (2) a far too limited use of sound administrative principles in public health; (3) a lack of sufficient numbers of specially trained personnel; (4) a failure among officials to take cognizance of economic considerations involved in malaria and malaria control; (5) an inadequate knowledge of methods for applying in a practical way the results of research.

Quoting again from Bernal (1939, pp. 385-6), 'the task of the future is to make the work of the scientist more conscious, more organized, and more effective; to create a proper appreciation of that work by the mass of the people and to link both together in a common effort to realize, in practice, the possibilities that science offers'.

#### *What to do?*

It is one thing to recognize social lacunæ that, even more than technical or biological ignorance, seem to be delaying the advance of malaria control. But it is quite another and more difficult matter for a director of health to devise a practical way to begin to close these chasms which are so huge that the handfuls of material available for filling seem scarcely worth using. Would that 'to do, were as easy as to know how to do'!

But, having attempted to outline the problem one may perhaps be permitted to mention some initial steps, some practical moves which would appear to be possible, in India for example, without much delay. In preceding paragraphs some of these and other points have already been mentioned.

To begin with, it is obvious that the need for enlightened public opinion can never be met until student training and health education have been developed to a vastly greater degree. A first practical step in each province or state would be to persuade the director of education to co-operate in setting up a suitable committee to prepare syllabuses for health education in the schools, from primary grades upwards. Until there are suitable courses and textbooks prepared by local authorities specially for local use there will not be much progress. Such a committee should consist of an experienced administrator in education, an outstanding teacher, and a capable health officer. It should not only outline courses but should also enlist properly qualified authors to prepare original textbooks



of hygiene and public health based on local conditions. Student training in public health has long been a feature of the Philippine Bureau of Education, in Manila, which would no doubt be pleased to send specimens of their excellent syllabuses and textbooks. A beginning has already been made along these lines in Madras, where a committee is studying this need for suitable outlines and school books in hygiene and public health.

Then, too, it is essential that much more emphasis be given in teacher-training schools and colleges to special instruction in the teaching of principles of hygiene and public health. If directors of public health will investigate, they will find that their subject is scarcely touched in teacher-training institutions. If courses are given, the instruction is generally perfunctory and has little or no practical value. An obvious first step for a director of health would be to obtain a copy of the syllabus used in teacher-training institutions in his province, to find out how inadequately the subject of public health is treated, and then to confer with the director of education and attempt to impress upon him the vital need for adequate *practical* student and teacher training in basic principles of, and social responsibilities for, hygiene and public health with special reference to malaria.

Health education for adults has been attempted in several provinces with indifferent success, largely because of a failure to realize that skilled, not amateur, direction is required. This specialty has been developed to a considerable degree in England, America, and Java. A first step in each province would be to send a suitable officer abroad for specialized training in this important field.

As regards administration, certainly a director of health should pause to study carefully his own system and locality to see if the needs as regards malaria control are being met. Perhaps on reflection, strategic changes could be devised which would effect notable results.

To secure adequate co-operation with departments of public works and agriculture no doubt directors of health will have to go more than half way. Having prepared facts and figures it might be possible, for example, to have conferences with directors of these two departments which would result in correcting or avoiding such serious blights as malaria due to irrigation. But the director of health must first have his basic data, photographs, and practical suggestions well in hand. Conferences, especially if held at a place where lack of co-operation has created malaria, will be found much more effective than correspondence. Perhaps a permanent *malaria prevention committee* could be formed, to consist of one responsible official, each from the departments of agriculture, public works, and public health, meeting once a month. Directors of health might also call to the attention of directors of public works the annual course in malaria for engineers, given

at the Malaria Institute of India in Delhi. This course is not designed to train malaria engineers but to instruct public works officials in some basic principles of avoiding malaria.

Skilled personnel is essential in malaria control. The chief institution in India for specialized training in malariology is the Malaria Institute of India in Delhi where there is an annual course which is open to selected health officers from the provinces and states. Full use of this facility, of course, should be taken, as well as of the courses at the All-India Institute of Hygiene and Public Health in Calcutta.

In any state or province where malaria is a problem it would also be useful to employ a malaria engineer. It is probably best to select a young graduate in engineering and to give him the necessary specialized training. Unfortunately, such specialized training in malaria engineering is not fully adequate in India but should be supplemented by study tours in Malaya and the United States. If it is not feasible to employ a malaria engineer perhaps a sanitary engineer with special training in malaria control can be added to the staff. As noted above, there should at least be inspectors or overseers qualified to run levels and construct drains.

As to medical entomologists, here again specialized training is essential. Well-qualified graduates in entomology are available in India and they can obtain locally the knowledge in regard to malaria that is required.

The idea of employing malaria agronomists is a new one but such specialists seem as logical a need as malaria engineers in a country like India, where at least three-fourths of malaria is rural and where it is so closely associated with agricultural procedures. Well-qualified agricultural graduates are available in India and can be trained locally in the principles of malariology. Every effort should be made to impress the department of agriculture with the importance of malaria control to the farmer.

One important and common defect in administrative procedure, as regards personnel, arises from the practice of service rotation. It frequently happens that by the time an officer has become well versed in the technique of malaria control the wheel turns and he is replaced by an untrained man. This precludes the possibility of technical competency. Such inefficiency might be avoided by an administrative change which would ensure that a man remaining in his malaria post would continue to make normal advances in seniority on the service lists.

An easily-made first step as regards developing official cognizance of economic considerations of malaria could be taken if a director of health would order some malarial-economic surveys in well-chosen villages and towns. Such survey should be made by a health officer, living in each town during the survey and becoming



well known and trusted by the inhabitants. Information should be obtained painstakingly as to vital statistics, spleen and parasite rates, value of houses, income, taxes, debts and interest on debts, payments to doctors, quacks, and priests for treatment of malarial fevers and days and wages lost because of malarial fevers. It will usually be possible to demonstrate that malaria control in such villages would be a good investment. Only by carefully collected and presented facts and figures can hard-headed revenue officials be persuaded to budget adequately for malaria control.

As to malaria research, probably this is done best by specially-trained personnel. Many excellent and basic malaria studies have been reported by such institutions as the Pasteur Institutes of Assam and Coonoor, the Haffkine Institute of Bombay, King Institute of Madras, the All-India Institute and the School of Tropical Medicine in Calcutta, and especially the Malaria Institute of India, in Delhi and Kasauli. But in every department of public health there are always a few officers who have a *penchant* for field research and they should be encouraged to do as much as possible in connection with their routine duties.

In applying the results of malaria research a director of health can take a first step by setting up a demonstration malaria control project in a typical area. Here methods can be tested and results displayed. It is important to choose at the same time a similar nearby area where no control is done but where simultaneous observations as to the incidence of malaria and of vector mosquitoes are carried out. This contrast area will serve to prove to lay officials that reduction of malaria in the controlled area has been due to the prophylactic measures and not to a cyclic decline. When the natural curve rises, as it always will sooner or later, the contrast may be convincing even to sceptics. The Malaria Institute of India has always been pleased to give technical assistance to provincial or state authorities setting up such demonstrations, in fact several are being aided at present.

So, it is apparent, there are certain practical initial moves which can be made to overcome the social obstacles to malaria control. One must not be discouraged by the magnitude of the problem or by the fact that decades will pass before there is appreciable national progress. Rather, one should be encouraged by the relative ease with which the above-mentioned first steps can be undertaken.

Quoting the late Sir Ronald Ross, malaria prophylaxis 'depends not so much on profuse expenditure as on the intelligence, enthusiasm, and energy of those who are responsible for sanitary affairs'.

#### Summary

This paper undertakes to point out that the main obstacles in the way of malaria control

(Concluded at foot of next column)

## ANTI-MALARIAL OPERATIONS IN INDIA

By P. N. BOSE, M.B., D.T.M., D.P.H.

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UNDER a grant from the Rockefeller Foundation the writer recently went round India on a study tour to acquaint himself with the anti-malarial operations going on in the different provinces. In the course of his tour he visited certain parts of Assam, Madras, Ceylon, Mysore and Delhi, and saw the anti-malarial work

(Continued from previous column)

to-day are not so much technical or biological as they are social. They appear to consist of such lacunae as (1) a fundamental absence of educated and effective public opinion; (2) too limited use of sound administrative principles in public health; (3) lack of sufficient numbers of specially-trained personnel; (4) failure among officials to recognize economic phases of malaria and malaria control; (5) inadequate knowledge of methods for applying *practically* the results of research.

In conclusion, the paper outlines certain initial steps which could be taken, in India for example, without much delay to eliminate these social reasons which appear to explain why malaria in the tropics and sub-tropics still takes first rank as a destroyer of prosperity, happiness, and health.

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there. This article is a brief summary of the impressions he gained about some of the measures employed and the results achieved.

#### Assam

*Gauhati*.—Gauhati is a town in the District of Kamrup with a population of about 22,000 (1931 census). After several thousands of dissections of anopheline mosquitoes, it was found that *A. minimus* was the chief vector and it was breeding in the Bharalu river and in irrigation channels to the north-east of the town. The infection rate was 3.23 per cent. By adopting anti-larval measures against this species the incidence of malaria in Gauhati has been brought down, as shown in the table below. Applying paris green and oiling of the breeding places are the chief methods adopted.

TABLE I

	YEARS					
	1935	1936	1937	1938	1939	1940
Spleen rate ..	13.2	8.0	6.1	5.4	7.2	2.9
Parasite rate	7.4	11.5	6.6	2.6	1.8	1.2

*Dishpur*.—Dishpur, a village with a population of about 300, is on the way to Shillong from Gauhati. Here spray-killing of adult mosquitoes is done regularly. The adjacent village of Japriago is kept as control. Pyrocide 20 (1 part diluted with 19 parts of kerosene) is used for spraying. The figures given below show the decline in the infant index and in the spleen and parasite rates.

TABLE II  
Infant indices—1940

		March	June	September
Dishpur	..	44.4%	20.0%	20.0%
Japriago	..	Not examined.	62.5%	50.0%

TABLE III  
Spleen rates (2 to 10 years)—1940

		March	June	September
Dishpur	..	71.5%	45.0%	46.0%
Japriago	..	83.8%	84.0%	73.0%

*Nongpoh*.—Nongpoh is a small official colony on the way to Shillong. Here one method of controlling the breeding places of larvæ is by the removal of aquatic vegetation growing in drains and channels. At one time Nongpoh

TABLE IV  
Parasite rate (2 to 10 years)—1940

		March	June	September
Dishpur	..	32.1%	27.0%	23.6%
Japriago	..	51.3%	76.0%	40.6%

was a very bad place for malaria but by clearing the weeds from the breeding places and spraying with oil, larval breeding has been brought down considerably and the place is now quite healthy and free from malaria.

*Shillong*.—In Shillong, the last epidemic occurred in 1932. The Assam Medical Research Society found an infection rate of 13.9 per cent in *A. minimus* and 0.31 per cent in *A. maculatus*. Both the species were found to breed in two large streams, the Umkhroh and Umshirpi and their tributaries. *A. minimus* was also breeding in a fairly large stretch of paddy field near the polo ground. Control measures have been adopted since 1933 under the Joint Malaria Committee and the following table shows the reduction in malaria that has been effected. The chief measures adopted are application of oil and paris green to breeding places.

TABLE V

		1932	1934	1940
Spleen rate ..		13.6%	3.5%	1.5%
Parasite rate ..		12.1%	4.7%	..

*Dhekiajuli T. E.*—In Dhekiajuli tea estate in Jorehat, control of *A. minimus* has been going on for some years. The work is being carried out under the direction of Dr. Manson. Shading of the breeding places is the chief method adopted there. The following plants are being used very effectively for providing shade, as they grow abundantly:—(1) *Dhuranta*, (2) *Tita-bakash*, (3) *Eupatorium* (Naga), (4) *Tarapat*, and (5) *Hibiscus*. Any one of these shrubs may be used. They completely shade the drains and canals in a short time and act as effective checks on *A. minimus* breeding.

#### Madras

*Pattukottai*.—Pattukottai is a town in the Tanjore district of the Madras Presidency. It was formerly a dry tract of country with red, ferruginous soil and was not malarious. Since the introduction in 1933 of irrigation from the Grand Anicut Canal, which originates in the Cauvery river, about 50 miles from Pattukottai, the following changes have taken place:—

- (1) Wet-weather streams are dry for a shorter period than previously.
- (2) Old tanks contain water almost throughout the year.

(3) The subsoil water level has risen considerably, making the place water-logged throughout the whole year.

(4) Untidy irrigation without proper drainage has taken place.

The irrigation season extends from about 15th June to 15th February which also corresponds with the malaria season. The density of *A. culicifacies*, which is the carrier, is greatest between the months of June and September. Although twelve other species of anopheles have been collected and studied, *A. culicifacies* is the only species responsible for malaria. It is, however, not a very energetic carrier as the combined gut and gland infection index is only 0.12 per cent.

It is supposed that irrigation and rice-cultivation are responsible for malaria at Pattukottai. The question as to why malaria is prevalent at Pattukottai and not at Tirubedu which is close by, though rice-cultivation is being done at both the places, is being studied. In Tirubedu the infection rate is very low, 0.01 per cent, and the density of *A. culicifacies* is also small. From the observations so far made it appears that the density of *A. culicifacies* is great in Pattukottai owing to the increase in the number of breeding places. Malarial incidence is high owing to high density of *A. culicifacies* though the infection rate is as low as 0.12 per cent. This suggests that one should not only consider infection rate but also the density and longevity of mosquitoes and coincidence with the malarial season, to explain malariousness of a place.

The reasons why irrigation has increased malaria in Pattukottai taluk are :

(1) Excessive and injudicious supply of water in canals.

(2) The digging of borrowpits to make embankments for canals. (The borrowpits are always full of water owing to high subsoil water level and seepage water.)

(3) The provision of defective sluice-gates permitting water to run here and there.

(4) Badly maintained canal banks with scouring and allowing the water to flow here and there.

(5) Absence of effective maintenance of field channels.

(6) Complete absence of drainage.

In Pattukottai at any rate the engineers are responsible for the above defects and the remedy lies in their hands. Experiments are being conducted to find out the value of minor and major engineering measures in reducing malaria. The borrowpits and low-lying lands in the town are being filled up, and proper drainage of the town is being maintained through well-built drains. The Rockefeller Foundation has taken two villages, Enadi and Senjaykollai, outside Pattukottai town, for experimental purposes. All the borrowpits and low-lying lands have been filled up there. Proper drains have been built. Irrigation-channel banks have been properly stone-pitched and maintained. Distributing channels

which supply water to the field, have been fitted with water-tight 'Calco' sluice gates, and intermittent supply of water from the main channel has been introduced. The land gets 5 days of water-supply and 2 days rest, but the earth remains moist so that there is no danger to crops. This has proved the most effective measure so far and the incidence of malaria has been reduced in these two villages. In the main channel, where there is water throughout the year, paris green application with a new type of distributor, devised by Mr. Knipe, is the method used for killing *A. culicifacies* larvæ; in the tanks *Gambusia* fish have been introduced in large numbers to destroy mosquito larvæ. The dustless method of paris green application recommended by Barber has also been resorted to for tanks and ponds. This is a very convenient method as the diluent used is water and one has not to carry such a large volume of material as when the diluent is soft stone or soap-stone or road-dust. The man carries a stock mixture of paris green, kerosene and egg-albumin and mixes it with water from the breeding place, puts it in the sprayer and sprays. The stock solution has the following composition :—Paris green 100 c.cm., kerosene 200 c.cm. and egg-albumin 1 grm., 25 c.cm. of the mixture is mixed with 5,000 c.cm. of water and spread by means of a Hudson sprayer.

Another interesting study, that is being conducted in Pattukottai, is on the ecology of *A. culicifacies*. The following points have been noted :—

(1) The question as to whether *A. culicifacies* is zoophilic or androphilic has been investigated by catching mosquitoes from (i) different catching stations in the villages; and (ii) mosquito-traps with young calves as baits. By this it has been found that *A. culicifacies* is not strictly androphilic (i.e., preferring human blood). This has been corroborated by the precipitin test. *A. culicifacies* may be found in both cattle-sheds and in human habitations.

(2) Irrigation channels are excellent breeding places for *A. culicifacies*.

(3) Newly dug pits near canals and paddy fields breed *A. culicifacies* larvæ more profusely than old ones.

(4) Fallow rice-fields are good places for *A. culicifacies* breeding.

(5) When paddy grows about 1 foot high, breeding of *A. culicifacies* stops.

(6) Pits simulating paddy-fields with paddy growing in them do not breed *A. culicifacies*.

(7) When paddy plants are grown inside wide test-tubes and put in the pits with water, so that there is no communication of water inside the test-tube and outside it, *A. culicifacies* does not breed. Hence the conclusion drawn is that it is the obstruction by paddy plants after they have grown to a certain height, that prevents *A. culicifacies* breeding in the rice-fields.

(8) Effect of shading has some effect (but not to any great extent) on the egg-laying of *A. culicifacies*.

(9) Egg output by *A. culicifacies* is most marked during the first four hours at night, i.e., from 6 to 10 p.m.

**Kasangadu.**—Kasangadu is a village in Pattukottai taluk. In view of the encouraging results obtained from spray-killing of adult anophelines by Ross in 1936, De Meillon in 1936, and Covell, Mulligan and Afridi in 1938, an experiment was undertaken in 1938 in this village on the value of spray-killing of adult mosquitoes in the control of malaria. The spray used was a mixture containing 19 parts of kerosene and 1 part of Pyroicide 20. The experiment was started in June and the results obtained by the end of the year showed that there was a distinct tendency for the spleen and parasite rates to drop in the sprayed village as shown in table VI.

TABLE VI

Month (1938)	KASANGADU		TUVARANGURICHCHI	
	Spleen rate	Parasite rate	Spleen rate	Parasite rate
April ..	41.1	39.8	41.3	37.0
November	24.0	11.5	61.0	52.0

The amount of money spent in the spraying experiment came to As. 1-11 per 1,000 c.ft. or As. 15-3 per capita per annum. Although the per capita cost of these measures is excessive and greater than that which a rural village can be expected to afford, the method was found to be quite efficacious in checking malaria and it should therefore receive attention, particularly in places where money is readily available, e.g., in military barracks, tea-garden bungalows, etc., and where anti-larval measures are extensive and expensive. To reduce the cost of spraying, attempts are being made to make the extract locally from the Nilgiri pyrethrum.

*Gambusia* has been found to be a good larvicidal fish at Pattukottai. *Gambusia* is being introduced in breeding places where application of oil or paris green is not possible. This fish is very hardy, can stand variation of temperature and handling, and breeds profusely in confined waters. Several nurseries have been constructed at Pattukottai and regular supplies of fish are being sent for use in tanks, wells, etc.

#### Ceylon

So far as malaria is concerned Ceylon may be divided into three regions—

(1) A dry zone including more than half of Ceylon—the whole of the north, east and part of the south-east. Average rainfall from March

to August, i.e., during pre-malaria and malaria seasons—10 to 20 inches. Spleen rate is very high—40 to 60 per cent or over. The area is full of forest and is very thinly populated owing to prevalence of malaria.

(2) A wet zone including less than a quarter of the whole area of Ceylon in the south-west. Average rainfall from March to August is 40 to 60 inches or at places more than 100 inches. Spleen rate is low—0 to 10 per cent—and so this area can be called the healthy area and is thickly populated.

(3) Intermediate zone—in between (1) and (2). Average rainfall during March to August is 20 to 40 inches. Spleen rate is 10 to 40 per cent and it is the most dangerous area.

*A. culicifacies* is the one species concerned in the transmission of malaria in Ceylon. It is essentially a dry zone species and is widely prevalent in the forest areas where malaria is hyper-endemic. In the wet zone *A. culicifacies* is much less prevalent and has a patchy distribution. In the intermediate zone, the distribution of *A. culicifacies* varies from year to year and is unusually plentiful during a year of drought or scanty rain. The close association of rivers with the breeding of *A. culicifacies* has been established. Whenever there is a lot of rain during the period from March to August, the rivers are full and there is little breeding of *A. culicifacies*, but if the south-west monsoon fails then water collects in the river beds into pools, and *A. culicifacies* breeds in plenty. Colonel Gill has explained the occurrence of the malaria epidemic in Ceylon in 1934, as due to severe and prolonged drought during the preceding year and the year in question. He states that all fulminant epidemics that have hitherto been studied (e.g., the Punjab epidemic) have invariably been associated with excessive rainfall or with inundations resulting from the outflow of rivers, but here in Ceylon the picture is different; failure of rainfall has been responsible for the epidemic. In both cases the humidity is to blame. High humidity determines the onset of epidemics in the Punjab, while in Ceylon it is the lowered humidity due to prolonged drought that causes epidemics. As a result of the study of malaria, particularly the fulminant type of epidemic, attempts are being made in Ceylon to check malaria and to prevent future havoc. Systematic collection of *A. culicifacies* larvæ and adults is being made under the direction of medical officers responsible for 1½ miles radius around their jurisdiction as well as in their own areas. The samples are identified either by the local staff or by the central laboratory and the records are kept in a systematic manner in the medical entomologist's office. The latter sends out instructions to the local medical officers for adopting anti-mosquito measures as and when required. Two systems are followed: (1) oiling of pools or along the sides of rivers or other water collections is done regularly; and (2) on receipt of

instructions from the medical entomologist, emergency oiling is adopted. Circulars regarding instructions relating to emergency oiling of rivers and streams are sent to medical officers. This is done on the basis of findings on larval output; and when there are grounds to believe that conditions are getting worse, and that unless they are checked they may lead to severe and widespread out-breaks of malaria. This emergency oiling is not commenced after the monsoon rains without notification from the medical entomologist.

*Chilow.*—This is a town almost at the sea level. Malaria is endemic in the town. The methods of malaria control adopted at Chilow are:

(1) Reduction of width of channels and drains by revetting and filling.

(2) Filling of swampy areas and pools with coir dust.

(3) Filling and draining of sides of ponds.

(4) Paris green application (2 per cent with soapstone) to drinking water supplies.

(5) Oiling with 'malariol' in other places.

(6) Biological control of wells and *gala*-wells (used for irrigation) with *Gambusia*.

(7) Construction of cemented permanent drains.

*Deduru Oya Catchment area.*—In Deduru Oya Catchment area in Chilow district, mosquito traps with human and animal baits were demonstrated. Big mosquito-curtains were placed in front of human houses and cattle-sheds to catch mosquitoes as they come out or go in to take their blood-meal. This method has been immensely helpful in the study of the bionomics of the vector species of the place. The collection time is usually from 6 to 8-30 p.m., and the number of adults caught gives an indication also of the extent of larval breeding going on at the time. It is in fact used as a check on the larval catches.

*Kurunegala.*—The town of Kurunegala with a population of about 10,500, is situated in the intermediate zone and was the most severely affected area in the 1934 epidemic. Here different naturalistic methods of control of anopheles larvæ are being tried.

(1) Agitation of the water in the breeding places; particularly in hill streams.

(2) Automatic flush syphon.

(3) Hand-operating flush.

(4) Stone packing.

(5) Fascine drain.

(6) Pollution of water by coconut husk.

The results of these have been quite encouraging, except the automatic flush syphon which very often gets out of order.

#### Mysore State

*Bangalore City.*—The area of Bangalore City is 15 square miles and the population is 2.5 lacs. It was malarious before 1927. Malaria control

work was started and in 1938 general mosquito-control was initiated. The two carrier mosquitoes are *A. stephensi*, breeding in wells, and *A. culicifacies*, breeding in tanks and borrow-pits. Wells used for drinking water are controlled by *Gambusia* and dirty wells by malariol. The latter is used for tanks and borrowpits. Minor engineering measures, such as filling-up of tanks, are also done. The following table shows the effect of control measures:—

TABLE VII

	Before 1927	After 1935
Spleen rate ..	25.0	0.22
Parasite rate ..	14.2	1.00

*Hiriyur.*—At Hiriyur the effectiveness of subsoil drains by means of stone-packing and of canalizing and training of a river were shown. Two per cent paris green mixed with charcoal dust is employed for dusting. But the work at Hiriyur is not satisfactory as after 12 years of continuous anti-malarial work the spleen-rate has been reduced only from 57 per cent to 35 per cent.

*Mandiya.*—Mandiya is a valley; its altitude is 2,191 feet above sea level, and it has a total rainfall in a year of 22.35 inches. Before 1932, cultivation depended upon rainfall, but in June 1932, irrigation was introduced, water being taken from the Irwin canal, and an epidemic of malaria started in August of the same year. *A. culicifacies* was found to be the carrier with 3.5 per cent infection-rate, and the spleen-rate shot up from 3.8 to 82 per cent in some places. Control work was started in 1935. Major engineering drainage is the chief problem. The subsoil water level has been raised considerably owing to irrigation, and the whole place, being a valley, has become swampy. Here is another example of malaria resulting from careless irrigation as seen at Pattukottai. Gradation and channeling of the whole valley are being undertaken by the engineering department. The special feature here is that the medical, engineering, agricultural and revenue departments are all working together in perfect harmony and the results that have been achieved are indeed praiseworthy. Though the place is still malarious, the spleen rate has markedly declined.

*Nagenhalli.*—Nagenhalli is on the way to Mysore and here malaria is due to rice cultivation. It is being controlled by paris green only. In 1929, the spleen rate was 90 per cent but by control of larval breeding by judicious use of paris green, it has come down to 25 per cent.

#### Delhi

Delhi was formerly highly malarious, but in recent years the incidence of the disease has

been greatly reduced by an intensive anti-malaria campaign, carried out throughout the urban area. The chief breeding places of the local malaria vector (*A. culicifacies*) are those provided by river flooding and by ill-regulated and excessive canal irrigation. A number of permanent engineering works have been executed, the main principle being the prevention of flooding from any source. Within the area thus protected, the ground is so dressed that local rain water is either drained off completely, or is directed into one or more tanks, or *lidos*, which are specially excavated for the purpose where necessary. Extensive filling operations have also been carried out in many parts of the urban area.

Other measures employed include the mosquito-proofing of cisterns and wells, the application of oil and paris green to breeding places and the stocking of ornamental waters with larvivorous fish (*Gambusia*). The problem of larval drift in the tail of the Western Jumna Canal and its distributaries is dealt with by the use of booms constructed of *sarkanda* grass. These trap the larvæ, which are destroyed by means of oil-soaked *bhoosa* thrown on to the water immediately above the booms.

The spray-killing of adult mosquitoes with pyrethrum insecticide, among communities especially exposed to infection, is an important feature of the campaign.

**Buzpur.**—Buzpur in the Kumaun District in the U. P. has a foot-hill malaria problem. *A. minimus* is responsible for transmission of malaria in that place. The aboriginal tribes of the place are Buxas and Tahrus. They have been exposed to intensely malarious conditions for centuries and have developed a high degree of immunity. Thus they carry the infection but suffer little. They are a real source of danger

to visitors, as most of them are gametocyte-carriers. The imported population from the plains of the U. P. are not immune, and they suffer much more severely from the disease. The subject of immunity in malaria can be best studied here.

### Conclusion

(i) Malaria is a great problem in India including Ceylon, and it is being tackled in all the important places.

(ii) The nature of the problem differs in different places.

(iii) Each place has its particular carrier-species of anopheles.

(iv) Bionomics of the vector species determines the nature of the anti-malarial measures to be adopted.

(v) In many places man is responsible for the introduction of malaria.

(vi) Naturalistic methods of control are more successful in some places than in others.

(vii) Permanent measures give better results and are more economical in the long run than temporary measures.

(viii) Spray-killing of adult mosquitoes is a measure of importance, particularly for military barracks, tea garden bungalows, etc.

### Acknowledgment

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## Current Topics

### Experiences with the Injection Treatment of Hernia.

By A. R. KOONTZ, A.M., M.D., F.A.C.S.

(Abstracted from the *Southern Medical Journal*, Vol. XXXIV, March 1941, p. 297)

I WISH to state at the outset that I am neither a protagonist nor an antagonist of this method. I undertook this work for the sole purpose of learning what value, if any, it held.

For many years I have given an elective course on hernia in the Johns Hopkins Medical School, and each year in the course, until the autumn of 1935, I have mentioned the injection treatment only to condemn it. The reasons I have always given students for not using the injection treatment have been as follows:—

- (1) The injection method does not cure the hernia.
- (2) Important structures may be injured by the injection.
- (3) The scar tissue caused by the injection makes operation more difficult when the patient does finally come to it.

However, by this time, so many favourable reports dealing with the injection method had appeared in the

literature that it seemed to me that I could no longer go on condemning it without having some first-hand information upon it.

I shall make no attempt in this paper to discuss the history of the injection treatment, the technique employed, or the relative merits of the various solutions that have been used. These matters have already been discussed at length by writers who have had far more experience with the method than I have.

In an effort to determine the relative merits of the various solutions that have been used for injection, I have used a considerable number of solutions, as follows: 'galtanol', 'neogaltanol', 'proliferol A', 'proliferol B', 'proliferol T-special', phenol-alcohol-oil of thuja solution, synasol, Mayer's solution, and phenol and glycerine solutions. I am not in a position at present to discuss the relative merits of these various solutions. Several of them have not been in use long enough to compare them with those used early in the series.

The number of cases in this series is small, totalling only 179. I hesitate to report this small series, and am impelled to do so only because I am constantly asked what my results with the injection treatment are,



and because I believe reliable workers in any new field should let the profession at large know what their results are, so that a proper evaluation of the new method may be made. If we waited until absolutely definite conclusions could be drawn with regard to the injection treatment of hernia, no reports would be made on the method for many years to come.

All but nine of the hernias injected in this series have been inguinal hernia. The series includes all varieties of inguinal hernias: direct and indirect, scrotal and non-scrotal, and recurrent. I have not considered femoral hernias as particularly suitable for the injection method. However, I may try the method on a limited number of cases at some later date. Umbilical and post-operative ventral hernias are not suitable for injection unless they are very small. If, however, they present a fascial defect only 1 or 2 cm. in diameter, the defect can readily be closed by the injection method.

The table shows the results obtained. I have made no attempt to show percentages of cures. The follow-ups have not been good enough, nor the length of time long enough, to make such figures at all worthwhile. The average number of injections and the average number of months that each patient was injected are rather high because in some of the older cases the hernias recurred and had to be reinjected. In some instances they recurred twice and were reinjected twice. Also, some cases were given strengthening injections as a precautionary measure months after the regular course of injections was stopped. The total number of injections and the total number of months treated (including the injection of recurrences) are included in each case. The number of short-period cures is rather impressive, while the number of long-time cures is not. This, of course, is partly due to the fact that the series is not an old one. The number of failures has not been large.

This man had a large scrotal hernia, and the injection treatment was begun on the patient's insistence, and after he had been strongly advised to have an operation instead. After having 38 injections the ring had been materially decreased in size, but the hernia was still not cured, and the hydrocele had developed. The patient then consented to operation, and at operation it was found that he had a sliding hernia. The bottle operation for hydrocele was done, the hernia was repaired with ox fascia, and the patient has remained well for the eighteen months since his operation. Sliding hernias have been considered contra-indications for the injection treatment, but it is well known that it is not always possible to make a diagnosis of a sliding hernia before operation. In this case, there was no difficulty in keeping the hernia reduced, apparently completely, although obviously not completely. This case shows, however, that if care is used in making the injections, placing them just under the aponeurosis of the external oblique and not too deeply, a sliding hernia may be injected without serious complication, but necessarily without cure of the hernia.

The most serious complication encountered was the formation of a deep abscess, following an excoriation of the skin due to the pressure of a rather severe truss. A gangrenous area of skin, 1.5 cm. in diameter, developed, and when this was removed the necrotic core was found to go down through the subcutaneous tissue to the aponeurosis of the external oblique. Some of the aponeurosis of the external oblique sloughed away, and the lesion required three months to heal. A lighter truss has been fitted on this patient and the injection treatment resumed.

In one umbilical hernia an abscess formed, which had to be incised, and in another one a small sinus developed, which healed promptly under proper treatment.

TABLE

Types	Number of cases	Average number of injections	Average number of months injected.	Number of cures less than 6 months.	Number of cures more than 6 months.	Number of cures more than 1 year.	Number of cures more than 2 years.	Failures	Incompleted or still under treatment.	Complications
Indirect inguinal (non-scrotal).	117	21	10	31	18	10	6	3	49	Epididymitis 1 Deep abscess 1 Hydrocele .. 1 Hydrocele .. 1
Indirect inguinal (scrotal).	20	31	14	5	..	2	1	4	8	
Direct ..	15	26	13	1	1	1	..	1	11	
Recurrent ..	18	32	23	3	2	3	2	4	4	
Umbilical ..	4	6	2	2	..	..	1	..	1	Abscess .. 1 Sinus .. 1
Ventral (post-operative).	5	6	7	2	1	..	..	..	2	

**Complications.**—There have been a fair number of cases in which a slight swelling of the cord followed injection, but in all cases this has subsided in a few days. There have been six cases in which the complication was more severe. In one case there was an epididymitis which subsided without any treatment except the wearing of a suspensory. In one case a small hydrocele developed, which completely disappeared in a few weeks without treatment of any sort. In another case a large hydrocele developed, which persisted.

In a few instances I have felt sure that the injections have gone into the peritoneal cavity. In these cases there has been generalized abdominal pain, and in some cases narcotics have been administered. In all cases the pain has subsided within a couple of hours, and there have been no untoward results.

I have operated upon several of the failures. While at operation a large quantity of scar tissue was found, the operation was not so difficult as the ordinary operation for recurrent hernia, as there was no distortion

of the anatomy which is often found at operation for recurrent hernia.

#### Discussion

It goes without saying that no hernia should be injected unless it can be kept constantly reduced with a suitable truss. At first I used the semi-rigid variety of truss, but during the last ten months I have been using elastic trusses. I believe that a rigid truss is apt to exert too much pressure and cause too much atrophy of the newly proliferated tissue. Elastic trusses are found capable of keeping hernias reduced, while not causing the marked atrophy that the rigid type causes. Some of the larger hernias are difficult to keep reduced, and in these cases any type of truss that will keep the hernia reduced should be used until the rings are so narrow that a lighter truss will prove efficacious. Trusses should be worn night and day during the first few weeks, after which they may be discarded at night. Naturally, the elastic type truss is much more comfortable to wear in bed than the semi-rigid variety. A great deal depends upon the co-operation of the patient. The truss should not be taken off until after the patient is lying down in bed, and should be put on before he gets out of bed, while he is still lying down. It should be put on if he gets up at night to go to the bathroom. The truss should be worn neither too tight nor too loose nor too high nor too low. The pad should rest just above the pubic bone, and the truss should encircle the body midway between the great trochanter and the crest of the ilium.

As with any new method, naturally, there is still much to learn about the injection treatment of hernia. It has been recommended by some writers that some of the solutions used be injected two or three times a week, while others are injected only once a week. I do not believe that the optimum time that should be allowed to lapse between injections has yet been worked out. Will injections given too closely together destroy new fibroblasts that have been caused to proliferate by previous injection? Will ground be lost by spacing the injections too far apart? So far as I know, sufficient experimental work has not yet been done to furnish the answers to these questions.

In this series patients from all age groups have been injected. Apparently the younger the patient the better the result. The number of children injected has been small, but the results have been uniformly good.

A group of patients in which the injection treatment seems to be especially indicated is the group of old patients with troublesome hernias, in which operation would be too hazardous.

Another type of hernia that is very favourable for the injection treatment is the recurrent inguinal hernia in which the defect through which the recurrence appears is small. I have one such patient who was operated upon three times on each side, and each time by an exceptionally competent surgeon. He came to me after the third recurrence, and the recurrence on each side was through a defect only about 1 cm. in diameter. Both of these were injected, and the patient has now been well for three years. Naturally, he is delighted with the result. I have another similar case, injected for hernias twice recurrent on each side, but this case has now been well for only a few months.

There is another type of patient in which I think the injection treatment is especially applicable. I refer to patients of the industrial class who, because of enlarged rings with slight impulses, are denied employment. I have a few patients of this class in whom I have been able to close the rings completely, who are free from impulses, and who have been accepted for employment in arduous tasks.

Patients who receive the injection treatment almost invariably say that they feel much better after they have had a few injections. The uncomfortable dragging down symptoms disappear.

#### CONCLUSIONS

(1) I believe that the injection method will have a permanent place in the treatment of hernia. Just how wide the scope of this place will be, it will take

years to determine. I further believe that the majority of the reports so far published have been too optimistic, and that the number of recurrences in ensuing years will reduce the high percentage of cures in the early reports.

(2) The chances are that the field for the injection treatment will be widened as methods and proliferating solutions improve.

(3) At the present time the injection treatment seems indicated in the following groups of patients:—

(a) In old people with difficult hernias that cannot be satisfactorily retained by a truss. Many of these cases can be cured and kept cured if they continue to wear a light truss, while recurrences ensue in a great many of them if the truss is discarded.

(b) In those patients who will not, on account of fear or other reasons, consent to operation.

(c) In those patients who do not feel that they can afford to take time off for operation, either for financial or business reasons.

(d) In patients in the industrial class who have potential but not actual hernias, and who are refused employment because of this.

(4) The most favourable cases for injection from the point of view of cure are fairly early indirect inguinal hernias, very small umbilical and post-operative ventral hernias, and small recurrent inguinal hernias.

### The National Loaf

(From the *Lancet*, Vol. I, 31st May, 1941, p. 698)

IN its first memorandum on bread the accessory food factors committee of the Lister Institute and Medical Research Council advocated the use of wheat flour in which 80-85 per cent of the grain was extracted instead of the usual 70-75 per cent as a step to improve the health of the nation, and they also recommended that calcium should be added to bread. The Government adopted the second recommendation but not the first and announced their decision to fortify white flour with vitamin B<sub>1</sub> and calcium. A year has passed but the bakers have still not received from the millers flour containing either added vitamin B<sub>1</sub> or calcium and there seems no certainty when they will. Meanwhile the Government, without much enthusiasm, have adopted a loaf baked from 85 per cent extraction flour without added calcium as the national loaf and are encouraging us to eat it. But they have not explained the situation, and the public are inclined to suspect that some sort of war-time substitute is being offered them. Few people have grasped that the national loaf is probably the best bread, judged on its food value, that they have ever eaten, for it has been selected after a most careful scrutiny of the nutritive value of the different parts of the wheat grain. In milling white flour 70-75 per cent of the grain is used, leaving at least 25 per cent of the grain not normally used for human food. If we are going to eat 85 per cent of the grain we are going to eat another 10 parts out of the usually unconsumed 25 parts, but obviously we have a choice as to which 10 parts we choose, and it is on the choice of these 10 parts that great care has been lavished. In a second memo on bread from the M.R.C., the parts of the grain to be included in the 85 per cent extraction flour are defined in detail, and we are told the reasons for the choice.

These reasons were not all nutritional; the æsthetic one of providing the whitest possible loaf compatible with nutritive excellence was never lost sight of. 'The loaf is cream coloured and brings you the cream of the wheat' might be used as a slogan to express the ideal of the Ministry of Food's advisers in their wish to comply with what is believed to be the prevailing popular taste. The digestibility of the loaf also received attention, and a low content of fibre or so-called roughage, not more than half that of wholemeal, was fixed so that delicate digestive tracts should not be irritated. In 85 per cent flour, as defined in the memo, the purely nutritive advantages which are undisputed are the higher content of vitamin B<sub>1</sub>,

of the vitamin-B<sub>2</sub> complex, of iron, and of protein of good quality. There is one admitted drawback; the browner the flour the more it contains of phytic acid and its derivatives, whose action is to precipitate and make unusable not only the scanty calcium in the bread itself but also that in the rest of the diet. There is little of these substances in white flour; in 85 per cent extraction flour there is a good deal more but only about half as much as in wholemeal. It was because of the extra phytic acid that the M.R.C. committee originally advocated the addition of calcium to the 85 per cent flour which they were recommending. Most dieticians agree that it would be a good thing to add calcium to white flour, since there is an insufficiency of calcium in small-income diets containing much bread, but the reason for adding it to higher extraction flours is much more cogent, and there can be no serious argument against it from the trade since the millers are already in the habit of 'improving' the baking properties of flour by adding acid calcium phosphate in about the same amount as it is now recommended to add calcium carbonate. In self-raising flour the amount of calcium salt habitually added is much greater.

When the M.R.C.'s new memo has been read, the reader is left wondering why the policy of fortifying white bread with vitamin B<sub>2</sub> should still be pursued by the Government. The arguments for adopting 85 per cent extraction flour with added calcium for universal consumption as soon as present stocks of white flour are exhausted seem overwhelming. Both the national (85 per cent) loaf and a fortified white one promise extra vitamins but the national loaf provides others besides B<sub>2</sub>. Further, the supply of protein in our present diet is meagre, and the opportunity to introduce more protein of better quality by a simple change in our most widely used foodstuff should not be missed. Lastly, there is the need of shipping space. In the last war this imperative necessity drove the extraction of flour to 95 per cent; a general advance to 85 per cent now would afford an appreciable relief. Against the change can only be set popular prejudice (much of which will go when everyone has sampled the national loaf), the better keeping qualities of white flour, and an understandable reluctance to scrap the machinery which is now producing vitamin B<sub>2</sub> cheaply and on a large scale.

## Reviews

**THE BRITISH ENCYCLOPÆDIA OF MEDICAL PRACTICE INCLUDING MEDICINE, SURGERY, OBSTETRICS, GYNÆCOLOGY AND OTHER SPECIAL SUBJECTS—COMPLETE INDEX. 1941.** Edited by Sir Humphry Rolleston. Butterworth and Company (Publishers), Limited, Bell Yard, Temple Bar, London. Pp. 486. Price, Rs. 20. Obtainable from Butterworth and Company (India), Limited, Bombay

BRITAIN Delivers the Goods. There have been moments when we wondered whether we in India would ever see the index to Sir Humphry Rolleston's now world-famous encyclopædia, but it has arrived.

It is a good index. It is a comprehensive but it is not a wasteful one. It gives the main references first clearly and then the subsidiary ones, so that the wood is not obscured by the trees. Finally, it doesn't overdo the 'see . . .', but whenever possible it gives you the main reference, volume and page. For example, Malta fever is described in the chapter entitled 'Undulant Fever', but if one looks up 'Malta fever', one does not find 'see undulant fever', but '12, 361'; whereas under 'undulant fever' the same main reference is given and nearly a column of sub-references. There is thus no duplication, but one is saved a second dive into the index. The point is stressed because the reviewer has so frequently been irritated by books in which this practice is not followed.

In conclusion, it can be said that it is an index worthy of the work which it serves. Incidentally, this volume almost fills another 'long-felt want', an English (as opposed to an American) medical dictionary.

We believe that it is still possible to obtain this invaluable encyclopædia and we strongly recommend those who have not yet subscribed to try to obtain a copy: it will be many years before it is out of date and the publishers have a scheme of supplementary volumes for the addition of new matter.

**STARLING'S PRINCIPLES OF HUMAN PHYSIOLOGY.** Eighth Edition. Edited and Revised by C. Lovatt Evans, D.Sc., F.R.C.P., F.R.S., LL.D. (Birmingham). 1941. J. and A. Churchill Limited, London. Pp. x plus 1247, with 673 illustrations, 7 in colour. Price, 32s.

EVERY medical man who wishes to keep up to date should periodically buy a book on physiology and we know no more readable book on the subject than the one under review. Its extreme popularity and the world-wide demand for this book makes it possible for the publishers to give it to us at a very reasonable

price for a book of its size and quality, especially in war time.

Physiology is a very live subject and much has happened since the last edition, five years ago. The book has been very largely rewritten, some sections completely, and, though obsolete matter has been deleted, about 150 pages have been added; this fact will depress the young student and give food for thought to the older ones who worry about the future. (Why is it that it is the older ones who have less future to worry about that do most of the worrying?)

The section dealing with the central nervous system has been entirely rewritten and, as one would expect, the next most extensive revisions have been undertaken in the chapters on the endocrine organs and on nutrition in general with the vitamins in particular. Also there have been considerable changes in the chapter on renal function.

A very important feature of this book is the numerous references, both general and special; in this edition many new ones have been added.

This is of course the book of choice for both the student and the practitioner. It is a remarkable achievement on the part of the publishers that the only sign of the war on the format is that some of the forms in the centre of the book are of different paper from the rest. However, we doubt if one per cent of readers would notice this.

**LECTURES ON WAR NEUROSES.**—By T. A. Ross, M.D., F.R.C.P. 1941. Edward Arnold and Company, London. Pp. vii plus 116. Price, 6s.

As the author states in the preface, this little book represents a series of lectures given at one or two centres during 1940. Their object is to help battalion medical officers and general practitioners to deal with patients suffering mentally from war strain. Dr. Ross is a psychiatrist with a very long experience and he delivers his points clearly and simply. That he has a well-grounded understanding of the human mind is evidenced by his view that the introduction of the sphygmomanometer is a disaster from which mankind has not yet recovered. The book deals with acute and chronic war neuroses to which is appended a note on civilian war neuroses. It is not a little surprising to find that war neuroses among civilians have been much fewer than were expected. Dr. Ross thinks that army discipline through which the soldier is reduced to a state of childhood may partly account for the relative frequency of neuroses among soldiers as compared with civilians who have been bombed in cities and towns

Dr. Ross has some interesting advice to give on the treatment of hysterical conditions among soldiers, including hysterical deafness. He is emphatically opposed to the use of apparatus in cases of this sort. He maintains that it is essential that the patient should know he was cured, because he himself changed his mind about something.

O. B-H.

**A TEXTBOOK ON THE NURSING AND DISEASES OF SICK CHILDREN FOR NURSES.**—By Various authors. Edited by Alan Moncrieff, M.D., F.R.C.P. Third Edition. 1941. H. K. Lewis and Company, Limited, London. Pp. xiv plus 639, with 142 illustrations. Price, 21s.

HERE is a comprehensive volume dealing with various disorders of childhood written mostly from the nursing point of view. 'Complete revision has been carried out for this edition, which is almost fifty pages longer than its predecessor.' A new chapter on 'Children in the Tropics' written by Lieut.-Colonel E. H. Vere Hodge has been added.

The first part deals with the general principles of medical and surgical nursing, with special reference to the technique and apparatus of the procedures described. Anaesthesia, hæmorrhage and shock, orthopaedic surgery, etc., have been described in separate chapters. The second part constitutes the bulk of the volume, and is devoted to various diseases of children, written in an elementary style. An appendix has been incorporated dealing with drugs, weights and measures, poisoning, recipes, physiotherapy, etc.

There are profuse illustrations with excellent drawings and photographs. The general production is of high standard.

The editor deserves congratulations for the manner in which he has welded the contributions of various writers, while preserving a continuity of style and general arrangement.

R. C.

**ACROCEPHALY AND ACROCEPHALOSYNDACTYLY.**—By David Ferriman, D.M. (Oxford), M.R.C.P. (Lond.). 1941. Oxford University Press, London, Humphrey Milford. Pp. x plus 119. Illustrated. Price, 10s. 6d. Obtainable from the Oxford University Press, Bombay and Calcutta

THIS monograph deals with a subject of medical curiosity that may interest a certain section of the profession.

Acrocephaly is said to result from an inherited defect of germ plasma giving rise to aplasia and incomplete differentiation of the skull so that the two sides fuse prematurely. When other bones are involved as well, the condition is called acrocephalosyndactyly.

The book is divided into two sections. The first part is a review of the subject with reference to history, ætiology, clinical and radiological signs, diagnosis, and treatment. Part two contains detailed records of eighteen cases with a few illustrations. Six families accounting for seventeen cases have been extensively investigated by the author. Consanguinity has not been found in any of these families. The book ends with a final discussion of some of the cases, followed by several tables of skull measurements.

R. C.

**PROBLEMS OF NERVOUS ANATOMY.**—By J. Boeke, LL.D. (Glas.). 1940. Oxford University Press, London, Humphrey Milford. Pp. vii plus 164. Illustrated. Price, 7s. 6d. Obtainable from Oxford University Press, Bombay and Calcutta

THE purpose of this book is to give an account of some of the fundamental problems concerning the anatomy and physiology of the human nervous system.

The book has been divided into four chapters—(i) changes in the spinal and sympathetic innervation of the skin during degeneration and regeneration; (ii) the sympathetic ground-plexus in the glands, muscles, and connective tissues of the body; (iii) the problem of the 'interstitial cells' in the sympathetic

nervous system—their relation to neurones, and the innervation impulse as a humoral change in the tissues; (iv) on the present state of the neurone doctrine and of our knowledge of the synaptic junctions between nerve-cells and end-organs.

There is much personal research and conviction of the author embodied in this book, but the author has included the opinion of other workers on the subject when considering the various problems under discussion in the different chapters of the book.

The book will be of interest to the specialist in neurology and advanced students of neurophysiology.

P. C. S. G.

## Abstracts from Reports

### REPORT ON WORKING OF BIOCHEMICAL STANDARDIZATION LABORATORY FOR 1937-1940 (31ST MARCH)

'FROM the number of enquiries received from all over India and from the interest evinced in this type of work from all quarters, including the medical and pharmaceutical professions and the lay public, there seems little doubt that the Biochemical Standardization Laboratory has filled a definite gap and removed a long-felt want in the medical and public health administration of the country', says Colonel Sir R. N. Chopra, Director of the Biochemical Standardization Laboratory, in his first report covering the period 1937-40.

The appointment of the Drugs Enquiry Committee in 1930 was the first attempt in India to study and investigate the problems pertaining to drug standardization and drug control. As a result of the committee's report, which revealed a serious situation in regard to spurious drugs, the Government of India passed the Drugs Act, 1940, and also established the Biochemical Standardization Laboratory in Calcutta (in 1937) as a small nucleus to be expanded later as the Central Drug Control Laboratory.

The functions of the laboratory are to assay and test chemicals, drugs, biological products and organo-metallic compounds, on request by any person, including local governments and provincial laboratories, to standardize methods of analysis and tests with due regard to the climatic and other conditions prevailing in different parts of India, to undertake commercial testing of drugs for manufacturers and dealers on payment of prescribed fees, and to prepare and maintain stable standards of strength, purity and quality for drugs. The laboratory acts as a 'National' distributing centre for International (League of Nations) standards for biological products, galenicals, organic arsenicals and endocrine products, and as an expert referee in respect of disputed analyses.

The laboratory is also expected to do research on the pharmacological testing of drugs, guide, co-ordinate and correlate the work of the provincial government laboratories and also to serve as the training ground for public analysts in the methods of chemical, biochemical and biological assay. The laboratory consists of a 'Pharmacology and Bio-assay Subsection' and a 'Pharmaceutical Subsection'.

During the three years under report, the laboratory carried out a general survey of the quality of medicinal drugs in the Indian market, both imported and locally manufactured. Specimens of drugs from various parts of India were secured and more than 1,500 samples of drugs were carefully tested by pharmacological and chemical methods. In every case a report on the quality of the sample was forwarded to the party concerned.

Digitalis, in the form of a powder, infusion or tincture, is extensively used in India and is the mainstay of physicians in certain types of cardiac trouble. Of the 163 samples of digitalis preparations tested in the

laboratory, only 22 per cent were found to be within the prescribed standard; about 14 per cent were found to be either completely inert or weak in potency and the rest varied from 30 to 79 per cent in potency.

Researches on the stability of tincture digitalis and liquid extract of ergot in the tropics have shown that the maximum period during which these two preparations may be expected to retain full potency in the ordinary storage conditions prevailing in Calcutta is about 12 months, or probably even less, from the date of manufacture.

Forty-four samples of tincture of strophanthus were biologically assayed and about 15 samples agreed with the standard while the rest were either high or low in potency. In either case the position was found to be far from satisfactory. The stability of these preparations under storage was similar to that of digitalis. Not one of the samples of tincture of scilla examined in the laboratory was found to conform to the standard potency.

Of 56 samples of posterior pituitary extract, both of indigenous and foreign origin, 19 samples were found to be below the declared potency while the rest could be considered as satisfying the potency required of them.

Only 19 samples were found to be of standard therapeutic potency out of 36 samples of liquid adrenaline hydrochloride.

Two samples (both foreign) of insulin, the well-known remedy for diabetes, were found to be satisfactory. A small number of organic, arsenic and antimony preparations were tested, both chemically and biologically, and in a few cases the toxicity results exceeded the safety limits.

About 1,400 samples of drugs, medicinal chemicals described in the *British Pharmacopœia* or the *British Pharmaceutical Codex*, including patent and proprietary medicines, were examined chemically. About 50 per cent of these were found not to conform to the standards or not to comply with the specifications claimed by the manufacturers and senders. About 75 per cent of these samples were manufactured or bottled in India.

This comprehensive survey, undertaken systematically for the first time in India, has revealed that there can be no doubt about the seriousness of the situation regarding drug adulteration in this country. Perhaps a more alarming picture would have been presented if proper arrangements were available for checking of imports, policing of manufacturing houses, frequent inspection of retail dealers' stores, etc. With the enforcement of the Drugs Act, such investigation is now possible.

With the object of warning non-ethical and fraudulent manufacturers and distributors in India and also of creating a consciousness amongst the consuming public of the importance of the problem of drug adulteration from the public health point of view, the laboratory has carried out propaganda by the publication of informative articles and through press circulars.

Tables of specimens analysed in the laboratory, a list of pharmaceutical preparations which the laboratory undertakes to assay, and samples of laboratory protocols of bio-assays are given in the appendix to the report.

#### ANNUAL REPORT OF THE INSTITUTE FOR MEDICAL RESEARCH, FEDERATED MALAY STATES, KUALA LUMPUR, FOR THE YEAR 1939. BY A. NEAVE KINGSBURY, DIRECTOR

THE trend of the activities of the institute has proceeded uninterruptedly throughout the year, although in certain directions the tempo has been slowed by the absence on furlough of two heads of divisions. The onset of war has had little effect either on the research programme or on the volume of routine examinations that form so large a part of the duties of some of the divisions.

It appeared prudent, however, to insist on all reasonable economy of stores and to encourage the further

utilization of local resources. There has been the fullest possible co-operation of all departments, and the bacteriological division no.

tubes, utilizes local agar after special treatment, and re-uses, with certain additions, medium that has been employed for the preparation of prophylactic vaccines.

The tuberculosis and nutritional survey has been extended to rural areas where 1,500 Malay and 3,600 (tuberculosis survey: 3,400) Tamil children and young adults have been examined. As accurate ages are seldom known, the molar teeth have been used as a basis for age grouping. Among the Malay school children the percentage of reactors (including ++, +, and ± readings) is twenty-nine per cent and, as is usual, positivity increases with age. The highest percentage of positives (thirty-seven per cent) was found in a relatively isolated rural area; the lowest (eighteen per cent) in a girls' school on the outskirts of Kuala Lumpur. On thirty-seven rubber plantations, twenty-three per cent of young Tamils were positive. Estates with the highest and lowest incidences have shown fifty-seven and twelve per cent of reactors respectively; on the former, two adult open cases of tuberculosis were discovered. Male reactors have been relatively more numerous than female, particularly among the Malays.

The nutritional survey is indicating that in rural areas sub-nutrition is prevalent among young Tamils. The average general physical condition is not good and the incidence of Bitot's spots, phrynodermia, angular stomatitis and rickets, etc., is indicative of a general dietetic shortage of vitamin A or its precursor and of other food essentials. On the other hand, the nutrition of Malay youth appears to be fair.

An improvement in the conditions that determine the sub-nutrition among Tamils does not depend entirely on the economics under which these rural populations have their being. The Department of Labour and the managers of many estates are fully alive to the situation. Much encouragement is given to the cultivation of vegetable gardens by the labourers; the planting of *ragi*, *paddy* and other crops is sometime undertaken by managements; and on some estates, the school children are now provided with a supplementary meal or a ration of red palm oil which is rich in carotene, the precursor of vitamin A.

Through lack of effort on the part of the cultivator the condition of many estate vegetable gardens leave much to be desired. Moreover, in not a few Tamil labourers the 'virtue' of thrift is over-developed and is practised to the detriment of reasonable feeding. On rare occasions, parents have even been known to limit the evening meal of children who have partaken of the food provided by the management.

The improvement of nutritional status by increasing the vitamin A, protein and mineral contents of dietetic is thus a complex problem. A solution might lie in the abandonment of food preparation by the family, a duty which is usually undertaken after a hard day's work. A return to the system of food provision as preparation by the managements such as was common in the days of indentured labour and which is proving so successful on the African mines, would appear to merit consideration.

Amelioration might well result from the employment on estates of gardeners to grow selected crops of high food value for sale to the labourers at nominal charge. Further, herds of livestock are a feature on many plantations. Cattle and goats that are permitted to graze on estate land are usually owned by the staff. A potential milk supply is thus available on many estates; potential only, because the price demanded beyond the means of labouring families. No grazing charges are made to the owners and it is suggested that these milk supplies could become actual by the institution of grazing charges, payable in milk to be delivered at the estate schools.

The Bacteriological Division has undertaken investigations in connection with the Vi antigen in the serological diagnosis of typhoid fever and as a means of identifying 'carriers'. Only in eight of sixteen



'clinical carriers', in five of ten 'convalescent carriers', in five of seven 'chronic carriers', and in none of three 'contact carriers' were positive results obtained. Particulars are given of certain enteric 'carriers'. Two were women whose culinary activities were responsible for the spread of infection; in one case the surreptitious sale to a mess, of cakes mixed under the most unhygienic conditions resulted in several typhoid cases.

From an analysis of nearly three hundred cases of dysentery, it is found that some twenty-five per cent were due to *B. flexneri*; ten per cent to *B. sonnei*; five per cent to *B. shigae*, while *B. alkalescens*, *B. dispar* and *B. schmitzi* accounted for the remainder. Attention is invited to the increasing frequency with which organisms of the Salmonella group are isolated from cases of diarrhoea, obscure fever, local lesions and in young children, even of meningitis. An interesting note is also included on the various micro-organisms that from the laboratory records are known to have caused cerebro-spinal meningitis.

An extensive trial of the prophylactic (gametocidal) value of plasmoquine, with particular reference to *P. vivax* malaria has been completed. The drug was given bi-weekly in an adult dosage of 0.02 gm. to a population of some 650 under almost ideal experimental conditions. The breeding of anophelines was uncontrolled and endemic malaria, mainly benign tertian, was moderately severe. The effects were decidedly disappointing for infected wild-caught anophelines continued to be taken, while newly arrived labour previously largely free from infection, and children newly born on the estate acquired malaria. Infections also occurred among anophelines experimentally applied to *P. vivax* gametocyte carriers who were known to have regularly taken their plasmoquine.

The testing of various anti-malarial remedies has been continued; at the end of the year Totaquina, Type I, 'M. & B. 744' and quinine-phenazone awaited the completion of therapeutic trials. New methods for the rapid staining of thick films have been developed; by one technique in which brilliant cresyl blue is employed for staining, the examination of a thick film is possible within two minutes of the drawing of blood.

An investigation of malaria in the Ulu Jempol Valley is being undertaken preparatory to the introduction of 'naturalistic' methods for anopheline control.

In connection with the filariasis enquiry dissections were continued until October of mosquitoes trapped from Ayer Mati on the Perak River. *Mansonia longipalpis* was in great predominance and throughout was found to be infected with larvae of *Mf. malayi*. Three *M. indiana* and two *A. umbrosus* were also infected. Filariasis exists on Penang Island in areas that differ greatly in topography from the infected districts of Perak and Pahang. Trapping was instituted and *M. uniformis* proved to be the predominant species, one of which was found to contain immature filarial larvae. It may well be that here, species other than *M. longipalpis* transmit the infection. Breeding places of *M. annulatus* and *M. ochraceus* hitherto unknown, have been discovered. The larvae, associated with *M. longipalpis* and *M. uniformis*, were attached to the roots of grass and other vegetation in partially shaded peaty water contained in drains cut through a swamp.

On Estate 'T' the finding of *A. maculatus* following extensive clearing and planting was recorded last year. Among thirty-six specimens dissected in the period under review one gland infection has been noted. *A. umbrosus* and *A. novumbrosus* continue to be the important vectors and infected specimens were trapped in all months except January, February and August: *A. novumbrosus* disappeared from August onwards. On Estate 'N.G.' *A. barbirostris*, *A. maculatus* and *A. umbrosus* were all found to be carrying.

The investigation of rural malaria in the coastal area of Selangor has been continued. Interesting results are recorded of changes in fauna following bunding to exclude sea water. Of the brackish water breeders, *A. bazeai* has vanished and *A. sundanicus* is disappearing, while their place is being taken by *A. separatus*.

In the Pathological Division the sera from monkeys previously inoculated with Japanese river fever and Sumatran mite fever, and that from the immunized horse have been found to have some immunizing value. *R. orientalis* has been successfully cultured in the yolk of developing eggs up to the fourth generation; guinea-pigs inoculated with yolk and with allantoin membrane from each generation reacted in the usual manner.

Experiments with a newly isolated strain of *Spirillum minus* have confirmed that this infection in rabbits may give rise to a positive Weil-Felix reaction, the titre with OXK (alch.) sometimes raising to over 1/300. It is interesting that after positive Weil-Felix results had followed the inoculation of *S. minus* into three rabbits and titres had fallen to normal, reinoculation with Japanese river fever virus caused no re-stimulation of agglutinins although characteristic ocular reactions developed. On the other hand, re-stimulation of agglutinins did occur in a rabbit when *S. minus* was inoculated after an interval following Japanese river fever infection.

The 'immobility' test has been utilized for the further investigation of experimental rat-bite and Japanese river fevers. Generally, sera having high Weil-Felix titres from human and rabbit Japanese river fever cases failed to immobilize *S. minus* although with two of six human sera, immobilization in very low dilutions did occur. This test was employed to assess the proportion of wild rats infected with *S. minus*. Eight of thirty-eight rats caught in Kuala Lumpur were thus shown probably to be infected; of three rats infected with *T. lewisi* the serum of one only yielded a positive result.

An investigation has been commenced to determine how long after manufacture, the virus of rabies can be demonstrated in anti-rabies vaccine. Following the intra-testicular injection of one c.cm. of newly prepared vaccine, two of two rabbits became infected, and after the vaccine had been stored for fourteen days, one rabbit of two developed symptoms.

## Correspondence

### MALARIA SPECIFICS

SIR,—We are extremely glad to let you know that we have invented an ointment which cures malaria miraculously simply by applying on a finger of any hand. We are posting two phails [sic] of the same to you as sample complete with direction, etc. Will you please try the same and let us have your opinion and views?

We are sure you will kindly comply with this request of ours and thus encourage.

... & Co.

[Note.—We have received the above letter. What are we to encourage, quackery? We do not propose to do so. Needless to say the 'phails' were true to their name.—EDITOR, I. M. G.]

### GLAUCOMA

SIR,—I have recently come across two cases of glaucoma who have said that on first getting up in the morning vision was fairly good, but that in a short while, an hour or so, it gradually faded and became practically nil. Is this a common experience, and if so what is supposed to be the explanation? I haven't heard of it before, nor read it.

G. F. ROWCROFT, M.R.C.S.,  
L.R.C.P., COLONEL.

'CULMORE',  
COONOR,  
9th September, 1941.

[We have referred this letter to the officer in charge of the Eye Hospital, Calcutta, who has kindly made the following comment.—EDITOR, I. M. G.]



'This is possible, and the explanation can be that the tension of the eye goes up and that there is increasing oedema of the cornea. We see this especially in epidemic dropsy glaucoma and in sub-acute attacks of chronic primary glaucoma.

Patients often exaggerate their symptoms when they say that their vision is practically nil. However, I have seen such a case in my own consulting room—a patient when he came in was able to see; after an hour all was very dim from the oedema of the cornea. I brought down the tension with a drop of 1 per cent eserine and the vision returned.'

### INSULIN REQUIREMENTS IN INDIA

SIR,—We are very interested to read the letters in your September issue, on the subject of 'Insulin Requirements in India.'

This most important preparation has now had further restrictions placed upon its importation by the Government of India in their notification of the 23rd August.

Insulin is classified by the Customs Authorities as a 'Chemical, Drug or Medicine, not otherwise specified' under Tariff No. 28, and is therefore included under Serial No. 13 of Part B of the Schedule, issued by the Government of India in their 'Gazette of India Extraordinary', and also by the Import Trade Controllers in their respective Public Notices.

The basic period on which licences will be given out has been fixed as between the 1st April, 1940, and the 31st March, 1941, in respect of Serial No. 13. During this period, stocks of German and Danish insulin were still available, and, therefore, the importation of insulin from America was not so heavy as it is at the present time.

One has to face the fact that, in spite of all possible effort to help the export of products from Britain, that country unfortunately has grave problems of her own: in the first place, many manufacturing concerns have been thrown out of gear by the attention of the 'Luftwaffe'; secondly, serious labour shortages have occurred owing to the calling-up of so many men for military duties; thirdly, a very large percentage of production to-day is needed for government and military purposes, and on top of all this comes the shipping question, which is still serious.

Even before the war, certain well-known brands of insulin manufactured in America were very popular in this market—and justly so, because of their reputation and the high standard of their products. To-day if insulin is to be obtained one must look more and more

to these American companies for help—yet, at this stage, the Government of India impose restrictions, and the quotas are to be based on a year which has little relation to present requirements!

With regard to the question of manufacture in India, this of course is a very desirable extension of the present rapidly-growing Indian pharmaceutical industry, but whatever can be done in this direction must be in the future, and there are several, very pretty problems which will have to be solved. The present position is that there is a serious shortage of insulin in this country, and the position will rapidly get worse under the restrictions imposed by the Government of India.

We notice that Dr. J. P. Bose states:

'The manufacture and the standardization of insulin can be taken up by any of the big manufacturing concerns in India.'

This may be so, but once again one comes down to the hard fact as to when such supplies would be available. Presuming that ample supplies of raw material are available in India, there is, firstly, the question of the necessary licence to manufacture.

Secondly, the all-important question of standardization and strict control on the finished product.

Thirdly, the supply and erection of the necessary complicated plant in the manufacture of insulin on a commercial scale—which is not, by any means, the same as making insulin for experimental purposes in a laboratory.

And, fourthly, the supply of the necessary neutral glass ampoules or phials and supplies of the special rubber caps and closures.

These are not problems that can be solved overnight, and the Indian pharmaceutical industry, even with the best will in the world, could not suddenly make available ample supplies of insulin.

We would therefore suggest that the medical profession in particular, and the medical, chemical and pharmaceutical associations in general, impress upon the Government of India the grave problem with which we are faced to-day, and request them to immediately withdraw the present restriction, not only on insulin, but on the importation of other urgently-needed and important biologicals and drugs of a like nature.

G. W. GOSLING,

Director,

Martin and Harris, Ltd.

BOMBAY,  
25th September, 1941.

## Service Notes

### APPOINTMENTS AND TRANSFERS

THE VICEROY AND GOVERNOR-GENERAL has been pleased to make the following appointments on His Excellency's personal staff:—*To be Honorary Surgeons*

Colonel H. E. Shortt, C.I.E., *vice* Colonel T. C. Boyd, vacated. Dated 14th February, 1941.

Brevet-Colonel (local Brigadier) B. C. Ashton, *vice* Colonel H. J. M. Cursetjee, D.S.O., vacated. Dated 23rd February, 1941.

The services of Lieutenant-Colonel J. P. Huban, O.B.E., Additional Deputy Director-General, Indian Medical Service, are placed at the disposal of the Government of the North-West Frontier Province, with effect from the 19th August, 1941 (forenoon), for appointment as Inspector-General of Civil Hospitals and Prisons and Director of Public Health, North-West Frontier Province.

Lieutenant-Colonel S. L. Bhatia, M.C., is appointed Additional Deputy Director-General, Indian Medical Service, with effect from the 19th August, 1941

(forenoon), *vice* Lieutenant-Colonel J. P. Huban, appointed Inspector-General of Civil Hospitals, North-West Frontier Province.

Lieutenant-Colonel R. F. D. MacGregor, C.I.E., M.C., is appointed Additional Deputy Director-General, Indian Medical Service, with effect from 12th September, 1941.

On his reversion from Military duty Major C. J. Joyce assumed charge of the office of the Civil Surgeon, Amritsar, on the forenoon of the 18th April, 1941.

Major E. A. O'Connor, an Agency Surgeon, is employed to officiate as Chief Medical Officer, and Inspector-General of Prisons in Baluchistan in addition to his own duties as Civil Surgeon, Quetta-Sibi, with effect from the afternoon of the 5th July, 1941.

The services of the undermentioned I.M.S. Officers are placed at the disposal of the Government of India in the Defence Department with effect from the date noted against each:—

Major E. G. Montgomery. Dated 27th June, 1940 (afternoon).

Captain F. W. Allinson. Dated 6th September, 1940 (afternoon).

Captain J. W. D. Goodall. Dated 14th December, 1940 (forenoon).

Major F. H. A. L. Davidson. Dated 19th June, 1940 (afternoon).

Lieutenant-Colonel B. H. Singh, m.c. Dated 14th May, 1941 (afternoon).

Lieutenant-Colonel B. G. Mallya. Dated 15th May, 1941 (afternoon).

Captain P. I. Franks. Dated 16th May, 1941 (afternoon).

Major C. L. Pasricha. Dated 15th March, 1941 (afternoon).

Major R. Linton. Dated 11th June, 1941 (afternoon).

Lieutenant-Colonel J. C. De. Dated 9th July, 1941 (afternoon).

Captain W. H. Niblock. Dated 15th August, 1941 (afternoon).

#### LAND FORCES

##### (Emergency Commissions)

The undermentioned Captain (on probation) is confirmed in his rank, subject to His Majesty's approval:—

L. R. Flowers. Dated 17th February, 1941.

The undermentioned Lieutenants (on probation) are confirmed in their rank, subject to His Majesty's approval:—

2nd January, 1941

J. M. Flower.

15th January, 1941

A. W. B. Strahan.

16th January, 1941

D. Robertson.

3rd February, 1941

P. Storrs-Fox.

15th February, 1941

C. M. Burnie. J. R. Davidson.

A. L. Sutherland.

17th February, 1941

H. B. T. Holland.

2nd March, 1941

W. Donkin.

1st February, 1941

M. Singh.	Z. A. Sapru.
T. E. Unny.	E. B. Mody.
V. R. Sane.	G. S. Sandhu.
D. J. Shroff.	K. A. Rashid.
M. S. Kapur.	M. P. Misra.
P. P. Hazari.	R. A. Hakim.
A. B. Gune.	C. M. Muthu.
S. H. Ahmad.	H. Singh.
N. Rahman.	D. Singh.
M. D. Joshi.	D. S. Gupta.
K. D. Veeraraghavan.	A. Thimmappaya.

2nd February, 1941

M. Somasundaram.	N. S. Pillay.
S. V. Kail.	R. Raghavan.

15th February, 1941

P. P. Rit.	M. S. Hashemi.
K. G. Koshi.	J. Chatterjee.
V. K. Pillay.	P. Subrahmanyam.
P. N. Roy.	A. H. Minhas.
N. Khansur.	C. L. Shukhija.
S. S. Sidhu.	D. R. Shirhatti.

R. Kaul.

17th February, 1941

B. C. Singh.

1st March, 1941

S. L. Sawhney.	T. M. Rao.
D. N. Vora.	S. Krishnamurti.
K. Minakshisundaram.	L. C. Waderha.
S. S. Kapur.	F. N. Shroff.
B. N. Trilokekar.	A. K. Ramamurti.
P. N. Rao.	M. Z. Y. Husain.
M. Jegaroyan.	B. P. Sinha.
S. K. Ghosh.	P. G. Rau.
G. N. Prabhu.	K. S. Rajagopalchary.

C. T. Shah.

2nd March, 1941

J. N. Ghosh.

15th March, 1941

N. S. Reddy.	P. K. K. Menon.
M. A. Haq.	K. V. Pillai.
J. N. Mukherjee.	V. N. Khadilkar.
B. Bhattacharyya.	H. P. Mehta.
K. C. Mukherjee.	M. Natarajan.
S. M. Khan.	S. Bunyan.
T. K. Narayanan.	A. Haq.
A. Ahmed.	S. K. Puri.

16th March, 1941

M. M. Singh Roy.	R. C. Mitra.
P. Ramamurti.	N. G. Kar.

B. Mahadevan.

17th March, 1941

B. N. Kapur.	H. L. Marathe.
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The undermentioned appointments to emergency commissions are made:—

##### To be Lieutenants

3rd January, 1941

George Beech Bowater.  
Thomas Brian Warrington Phillips.  
Joseph Francis McGarity.  
Benjamin Ifor Evans.  
James Leslie McCallum.  
Edward Gerald Robert Butler.  
Noel St. George Wade.  
Robert Hermon.

The undermentioned are granted emergency commissions:—

#### INDIAN LAND FORCES

##### To be Lieutenants (on probation)

12th April, 1941

Joseph Pereira.  
Jyoti Ranjan Sen Gupta.  
Raghunath Krishna Garde.  
Sundarlal Agarwala.  
Chaturbhujdas Mangaldas Desai.  
Habibullah Khan Musazai.  
Ghulam Sarwar Ahmad.  
Chandulal Mathurdas Patel.  
Kali Pada Mukherji.  
Thomas George.  
Codanda Iyanna Somaya.  
Prem Shanker Bhargava.  
Sudhir Mohan Dutt.  
Gaganchand Ray.  
Suchit Mohan Dass.  
Fida Mohammad Khan.  
Walter Harris Roberts.  
Kazi Abdul Jabbar.

Vappalakalathil Balakrishna Menon.  
 Prabandhan Rangachar.  
 Sardar Ali Sheikh.  
 Gobind Lal Dutt.  
 Koka Krishna Rao.  
 Anil Prasanna Banerjee.  
 Biradavolu Durga Prasada Rao.  
 Raghavachari Narasimhan.  
 Wunnavu Venkata Bapaiah.  
 Ram Ekbal Sinha.  
 Ali Akbar Shah.  
 Damaraju Sree Krishnamurthi.  
 Thalakodi Madhathil Balakrishna Nedungadi.  
 William Samuel Raju.  
 Vangipuram Raghavachar.  
 Anilkumar Maganlal Patel.  
 Amarendra Nath Banerji.  
 Thekkethalackal Uthup Poonnen.  
 Brahma Nand Singh.  
 Anant Rajaram Deshpande.  
 Satya Pal Bhalla.  
 Alexander Kaniantharai Thomas.

13th April, 1941

Aylore Narayana Subbaraman.

#### INDIAN MEDICAL SERVICE (DENTAL BRANCH)

*To be Lieutenants (on probation)*

5th June, 1941

Ravinder Nath Dogra.  
 Indar Mohan Manchanda.  
 Wardev Singh.  
 Ramdas Bhagwandas Sagreiya.  
 Jagdish Singh Loyal.

#### PROMOTION

*Colonel to be Major-General*

H. J. M. Cursetjee, D.S.O., K.H.S. Dated 12th July, 1941.

*Lieutenant-Colonel to be Colonel*

J. P. Huban, O.B.E. Dated 26th August, 1941, with seniority from 23rd March, 1937.

The undermentioned Indian Medical Service officer is advanced to the List of Special Selected Lieutenant-Colonels:—

Lieutenant-Colonel J. C. John, O.B.E. Dated 8th July, 1941.

The provisional promotion to his present rank of Major M. G. Saincher is confirmed.

*Captain to be Major*

R. D. MacRae. Dated 1st September, 1941.

The following promotions are made:—

#### INDIAN LAND FORCES

*(Emergency Commissions)*

*Lieutenants to be Captains*

1st September, 1941

Y. S. Bawa.	S. C. Sarkhel.
D. C. Roy.	C. C. Menon.
K. Ramakrishnan.	K. G. Menon.
P. U. Rao.	R. Ananthanarayanan.
K. B. Menon.	A. A. Khan.
P. R. Raju.	N. Ahmad.
K. C. Ganapathy.	P. S. Viswanathan.
T. K. Rithuparnan.	B. L. Kamra.
D. N. M. Rao.	G. V. Rao.
K. P. B. U. Nayar.	P. Damodaram.
K. S. R. Krishnan.	B. Ahmad.
K. Paidilingam.	K. N. S. Nair.
V. P. Patel.	S. Singh.
S. Sivarajan.	S. G. Sundaram.
G. Das.	M. H. Ahmed.
J. R. Sen.	A. Jabbar.

H. K. Lal.	D. R. Batura.
M. Qamaruddin.	T. S. Khurana.
S. L. Rikhye.	B. Kishore.
E. N. C. Benjamin.	B. C. Bhalla.
S. C. Chatterjee.	S. C. Mazumdar.
R. K. Arora.	

#### RETIREMENTS

Major-General P. S. Mills, C.I.E., K.H.P. Dated 23rd August, 1941.

Brevet-Colonel A. M. Dick, C.B.E., V.H.S. Dated 30th July, 1941.

Lieutenant-Colonel J. Findlay. Dated 19th August, 1941.

Lieutenant-Colonel C. J. L. Patch, M.C. Dated 19th February, 1941.

#### RESIGNATIONS

Army in India Reserve of Officers.

#### MEDICAL

Captain G. C. Banerji. Dated 1st January, 1939.

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## Original Articles

## ENDEMIC TYPHUS IN MYSORE

By ROBERT HEILIG, M.D.

Professor of Medicine, Medical College, Mysore  
and

V. R. NAIDU, M.R.C.P. (Lond.), etc.

Professor of Pathology, Medical College, Mysore

HANS ZINSSER's book *Rats, Lice and History* has depicted impressively the important rôle of typhus in the cultural evolution of the human race. The epidemic form of the disease has even changed the history of nations. A certain uniformity in the symptomatology has been established in the louse-borne epidemic form as a contrast to the numerous endemic forms. The manifestation of the tsutsugamushi fever of Japan, the Mexican tabardillo fever, the spotted fevers of different localities are examples of such endemic varieties.

In spite of the divergent manifestations of endemic typhus, four signs are more or less constant, though certainly not all of them are to be found in every individual case: fever, rash, agglutinins to a proteus strain (Weil-Felix test) and the presence of Rickettsia bodies, demonstrable by animal inoculation. Three of these signs, for example, fever, rash and positive Weil-Felix reaction, or fever, rash and Neill-Mooser reaction, are sufficient to make a diagnosis proof against any doubt; even fever and a typical rash combined with other characteristic clinical features are a firmer ground for the diagnosis of typhus, than fever and Weil-Felix reaction without a rash, though recently such cases have been reported as definite typhus cases from Bombay (Patel, 1940) and from Bangalore, where only 12 out of 56 cases had a typical rash (Sharma, 1940).

Many interesting case reports have been added to the literature on typhus from India since the first publication of Megaw (1917) on the subject. In his later reports, he classified the Rickettsial diseases as louse-, tick-, mite-, and flea-borne depending upon the vectors. This has given an impetus to the investigation of the possible vector in localities where, off and on, a few endemic cases occur. Recently, we observed four clinically pathognomonic cases in the Krishnarajendra Hospital between November 1940 and February 1941 and the case reports with pathological investigations are submitted.

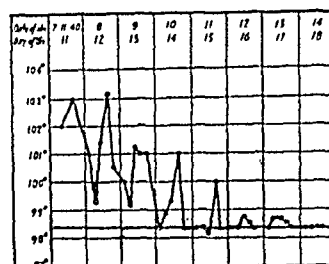
## Case report

Case 1.—Hindu Brahmin, Jail Superintendent, Mysore City, age 37, admitted 7th November, 1940:—

Eleven days prior to admission, the patient, who had been in perfect health for many years, fell ill with severe headache and mild symptoms of a cold and fever: the temperature was nearly normal (99°–99.2°) every morning, and shot up every evening between 4 and 5 p.m. to 102°F.–103°F., accompanied by a

chilly feeling (never by a rigor), and increased headache; on the 9th day of the fever, the patient observed a pink rash on the forearms, hands and legs, which spread the next day (10th day) to the back and to a less extent on to the chest. The next day (the 11th day) on admission

Case 1. Mr. S. I.



we found the rash very distinctly visible on the patient's fair skin, more or less regularly distributed on arms, legs, chest and abdomen and especially numerous on wrist, palms of the hands, feet and the back; the face was free. The efflorescences were discrete and nowhere confluent. The macular and maculo-papular rashes were pinkish and faded on pressure; while the ecchymotic ones were dark purple in colour and failed to fade on pressure. Apart from the rash the patient showed a well-marked conjunctivitis. No pathological signs were present in the heart, lungs, or in the nervous system; the tongue was moist and furred; the liver and spleen were not enlarged. The temperature on the day of admission reached 103°F., pulse rate 124, respiration 28 per minute. The patient complained of pronounced headache, poor appetite and slight constipation. On the following three days the rash did not change much, except for the spots on the wrists, feet and palms getting darker and browner with a copperish tinge. The following week the macular and maculo-papular non-petechial rashes began to fade gradually, while those ecchymotic ones on the hands, feet and on the back remained distinctly visible by deep pigmentation. The temperature which was swinging from 99.2° at 8 a.m. to 103°F. at 4 p.m. on the 12th day reached 101.2° on the 13th, 101° on the 14th, 100° on the 15th day and remained nearly normal, not exceeding 99°, on the 16th and 17th days, and became perfectly normal from the 18th day onwards. The pulse rate varied according to temperature, coming down to 84 on the 17th day. Convalescence was short and complete recovery soon followed.

## Laboratory findings

Urine and stool examination.—Nothing abnormal.

Blood examination.—On the 13th day: leucocytes—12,800.

Differential picture: Polymorphonuclear—71 per cent. Lymphocytes—23 per cent. Monocytes—5 per cent. Eosinophils—1 per cent.

No malarial parasites.

Malarial-flocculation test (M.F.) negative.

Widal for typhoid, paratyphoid A and B: negative on the 12th and 16th day.

Weil-Felix: OX19, OXK, OX2 negative on the 14th day and 18th day.

Wassermann

Kline

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D E

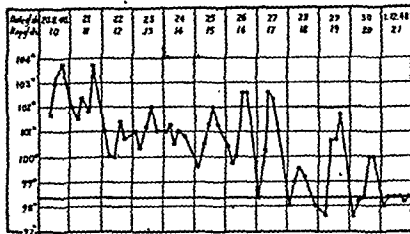
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A fortnight later all were negative.

Regarding the vector question, lice were improbable as the patient was a man of clean habits. Neither lice nor eggs were found on his clothes. Tick- and mite-bite was definitely denied and it was most improbable as he neither left the city nor had any close contact with cattle. But when we asked for possible contact with rats, he implored us to help him to get rid of them as he estimated the rat population of his house as several hundreds.

Case 2.—Hindu Brahmin, wife of a medical college student, age 21, was admitted on the 20th November, 1940, complaining of continuous fever for 10 days, varying daily between 100° or less in the morning and 103° to 104° in the afternoon; no rigor but severe

#### Case 2. Mrs. L.



headache and joint pains in all limbs. Two days prior to admission—on the 8th day of fever—a pink rash appeared on arms and thighs, spreading the next day to the hands, feet, back and much less to chest and lower abdomen; face and neck however remained free. Patient complained of loss of appetite and considerable constipation. Bowels moved only by enema. On admission, we found the slim but well-built lady without any pathological signs in the heart, lungs and abdomen. The tongue was moist and furred; liver and spleen not enlarged; very definite conjunctivitis; the painful joints showed no redness or swelling; the rash consisted of macular, maculo-papular and petechial spots of lentil-size and of pink to purplish colour, distributed as in case 1, everywhere very distinctly visible, leaving face and neck free; temperature on the 10th day at 5-30 p.m. was 104°F., pulse rate 124, and respiration 26. The further course showed remittent fever up to the 16th day, minimum near 99° and maximum between 102° and 104°; intermittent fever continued from the 17th to the 20th day, the maximum on the 19th day being still 103°, on the 20th day 101°, from the 21st day, normal; the pulse rate corresponded with the temperature. The convalescence was rapid and uneventful. Pigmented spots remained clearly visible on the fair skin for several weeks, especially on fore-arms, wrists and palms of the hands and ankles; they were still faintly present on the ankles even 7 months later.

#### Laboratory findings

**Urine examination.**—A small amount of albumin and a few granular casts, both absent on the 20th day.

**Stool examination.**—Nothing abnormal.

**Blood examination.**—On the 11th day: Leucocytes—11,200 per c.mm.

Differential picture: Polymorphonuclears—67 per cent. Lymphocytes—28 per cent. Monocytes—4 per cent. Eosinophils—1 per cent.

On the 16th day: leucocytes—9,200.

Malarial parasites not found.

Malarial-flocculation (M.F.) negative.

Wassermann reaction—negative.

D E

Kline ++ ++

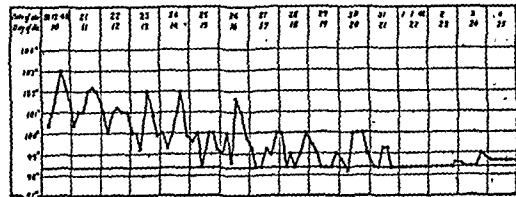
Lice could be excluded by the patient's social standard and by examination; tick- and mite-bite was definitely denied. But the young couple lived for several weeks, until about seven days before the fever started, in a village 14 miles from Mysore, swarming with rats.

Case 3.—Mohammedan, age about 45, wife of a grain merchant, living in Nanjangud, 15 miles from Mysore City, was admitted on 20th December, 1940:—

Ten days ago fever and bad headache started, the temperature coming down in the morning, rising without rigor but accompanied by a chilly feeling every

afternoon. The patient felt very weak, had no appetite, and was slightly constipated. Nine days after the fever began, a rash appeared, observed first on the face and simultaneously on arms, hands, legs and dorsum of the feet, the next day on abdomen, back and sacral region. On admission, the tall and strongly built

#### Case 3. Mrs. S. K. B.



patient complained of unbearable headache but no other pains, complete loss of appetite, repugnance for food, dryness in the mouth and thirst. The tongue was dry and covered with dark brown crusts; the eyes blood-shot; heart and lungs showed nothing abnormal; abdomen soft, not tender; liver not enlarged, spleen slightly enlarged. In spite of the dark skin of this patient a rash was so distinctly visible that it was quite impossible to overlook it; discrete maculo-papular and petechial efflorescences of deep purplish or copper-red colour and lentil to twice lentil-size covered the forehead, back and sacral region, abdomen, arms, hands, thighs, calves and dorsum of the feet in almost uniform distribution; on the chest only a few spots were present. Some of the slightly elevated papules disappeared on pressure, but most of the dark spots remained visible, due to their petechial character. Temperature was remittent between 100° and 103° up to the 14th day; intermittent, coming down by lysis from the 15th to the 21st day; and remained normal from the 22nd day; pulse rate 130 on the 11th day, 84 on the 22nd day. The patient's condition became restless and from the 13th to the 16th day she was almost comatose and could not be awakened from her 'typhoid' state. She passed urine and stool unconsciously. From the 17th day onwards with a temperature not exceeding 100° and a pulse rate below 100, she became clearer hourly and perfectly normal on the 20th day. She recovered from then on surprisingly quickly and left the hospital in good condition on the 20th day. At that time pigmented remains of the rash were distinctly visible all over the body with slight peeling on wrists and palms of the hands. When we saw the patient six weeks later, on the 3rd March, 1941, pigmented spots were still present on the palms and dorsum of the feet.

#### Laboratory findings

**Urine examination.**—Albumin in traces; a few red cells present.

#### Blood examination

Days of illness	Leucocytes per c.mm.	Polymorphonuclear percentage	Lymphocytes percentage	Monocytes percentage	Eosinophils percentage
11th .. ..	13,800	65	31	3	1
17th .. ..	14,000	70	28	1	1
Nine weeks later (3rd March, 1941).	9,900	43	43	6	8

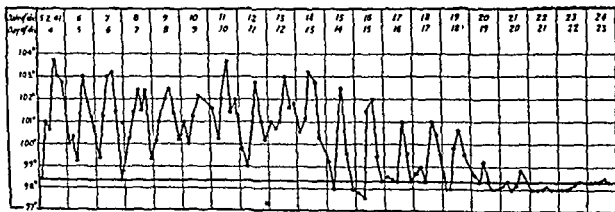
Malarial parasites not found.  
 Malarial-flocculation (M.F.) positive.  
 Widal: for typhoid and paratyphoid A and B: 13th day negative.  
 Weil-Felix: for OX19, OXK, OX2 (17th, 21st and 9 weeks later): negative.  
 Wassermann: 13th day  $\pm$   
 20th day  $\pm$   
 9 weeks later negative.  
 Kline: 13th day D E  
 $\pm$  +  
 20th day + +  
 9 weeks later negative.  
 Kahn: 20th day and 9 weeks later negative.

We tried also in this case to get some information about the vector. The patient and her family were clean and well-to-do people, and certainly not infested with lice. All our questions regarding the possibility of tick- or mite-bite or any sore, glandular swelling or groin pains as a result of it were denied. We were however assured by the patient and her relatives on questioning, that there were undeniably a large number of rats in her house. In order to investigate the truth, we sent one of our final year students to Nanjangud who spent a day with them. On return, he described that there was no separate godowns for storing their grain but the bags were stacked actually in the living room and the rats were rampant. It was surprising to learn from him that the rats lived as though they were part of the family and when the lady had returned from hospital to her home, she noticed a rat nest beneath her pillow.

Case 4.—Hindu-Vokaligar, a high school student, age 17, living in a village on the outskirts of Mysore City, admitted 5th February, 1941:—

The only complaints of the well-built patient were continuous fever and severe headache for the preceding three days. There was no rigor, no cough nor other

Case 4. Mr. H. S. H.



pains. The only objective findings on admission (4th day) were conjunctivitis, a whitish fur covering the moist tongue, a slightly congested pharynx and a doubtfully palpable spleen. Temperature was deeply remittent, varying every morning between 99° and 100°F., every afternoon between 103° and 104° up to the 15th day, becoming gradually lower from the 16th and remaining normal from the 20th day on; pulse rate came down from 120 on the 6th to 82 on the 20th day. On the 10th day from the beginning of the fever a rash appeared on the forearms, the dorsum of hands and feet, spreading on the 11th day to the extensor surface of the legs and the palms of the hands, and on the 12th day over the whole back, developing also a few spots on the lower abdomen and very few on the chest. On the dark skin of the boy the brownish-purplish colour of the maculo-papular spots as seen in figure 1 and figure 2 were better visible than the subcuticular petechial spots which became more distinct on the following days. The appearance of the rash had

no influence on the temperature or on the general condition; the patient continued to complain of headache, weakness and lack of appetite, especially when the fever rose every afternoon. From the 15th to the 20th day the rash faded gradually on arms and legs leaving behind dark brown spots in great numbers on hands and feet clearly visible for at least 3 weeks after the temperature had subsided and complete recovery was achieved. Peeling was present during the fourth week.

#### Laboratory findings

Urine examination.—Nothing abnormal.  
 Stool examination.—Pin-worm ova found.

#### Blood examination

Days of illness	Leucocytes per c.mm.	Polymorphonuclear percentage	Lymphocytes percentage	Monocytes percentage	Eosinophils percentage
4th .. ..	13,000	..	..	..	..
11th .. ..	16,800	61	28	9	2
27th (in full convalescence).	14,400	56	38	4	1
32nd (in perfect health).	8,000	52	44	..	4

Malarial parasites not found.  
 Malarial-flocculation (M.F.) negative.  
 Widal: for typhoid and paratyphoid A and B: 8th and 12th day negative.  
 Weil-Felix: for OX19, OXK, OX2 on the 11th, 20th and 32nd day negative.  
 Wassermann: 12th day  $\pm$   
 22nd day  $\pm$   
 Kline: 12th day D E  
 $\pm$  ++  
 22nd day ++ ++  
 Kahn: 12th day negative.  
 22nd day negative.

#### Neill-Mooser's reaction

On the 11th day, a day after the rash appeared, 5 c.cm. of the patient's blood was injected into two guinea-pigs intraperitoneally. On the 5th day the animals' temperature shot up and continued high for nearly 15 days, varying between 102° and 105°F. On the 9th and 10th day the two animals showed definite swelling and tenderness of the scrotum (Neill-Mooser's reaction). On the 12th day cardiac blood drawn from the guinea-pigs were reinjected intraperitoneally into other animals and reproduced the disease in the second group. Weil-Felix tests done by the blood drawn from these guinea-pigs on the 12th and 20th day were less than 1 in 40 for OX19, OX2 and OXK and can be considered to be negative.

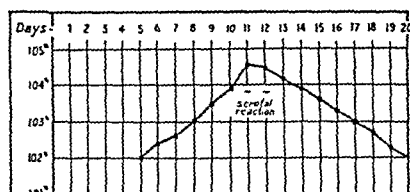
A typical temperature chart and a picture taken during the height of the scrotal reaction are reproduced here (figure 3).

Two of the animals were killed on the 16th day of the infection and imprint preparations were made from the tunica vaginalis and stained with Castañeda's stain. Paraffin sections from



brain, spleen, liver, kidneys and muscles were also examined microscopically. The sections of brain, kidneys and muscles did not reveal anything pathognomonic. In the spleen and liver however there was evidence of proliferation of endothelial lining cells in the smaller vessels and the thickening of the vessel walls. Neither Rickettsial bodies in the endothelial cells nor adventitial reaction were present in these.

Temp Chart and Scrotal reaction Guinea pig No 1



The imprint preparations showed large numbers of intra- and extra-cellular small coccoid Rickettsial bodies, measuring roughly  $0.25\mu$  to  $1\mu$ , taking up a lilac tint. Most of them were intra-cytoplasmic and none intra-nuclear. The extra-cellular ones were associated with ruptured and mangled cells. In some cells they were in several hundreds and in others only a few.

Again lice, ticks and mites were improbable as Rickettsia-conveying factors. The patient was perfectly clean, and his hair well kept; he denied having been bitten by ticks or mites, or having observed on his body any marks of such a bite described by us to him. We were told that plenty of rats lived in his house and to make sure about the local conditions, we went to his dwelling place, a village near Mysore, and found the living room of the family crammed with *ragi* and *dāl* sacks. The adjoining bedroom of our patient was in open communication with the loft, which was swarming with rats.

#### *Clinical picture summarized*

*Sudden onset* with malaise, severe headache, occasional joint pains, chilly feeling, but no rigor. Temperature is high from the beginning, of remittent character, returning to normal by short lysis towards the end of the third week. Pulse and respiration rate are increased according to the temperature. Conjunctivitis appears very soon and is a prominent feature for the first two weeks or longer, giving the eyes a blood-shot appearance. Tongue moist, covered with a white fur in the milder, dry and coated with brown crusts in the severer cases. Spleen just palpable or not enlarged. The mental condition was clear in three and seriously obscured in one of our cases, who remained for several days in a typhoid state.

A maculo-papular rash appears by the end of the first or the beginning of the second week; its colour varies according to the intensity of the patient's pigmentation from pink to dark purplish or copper colour; the single efflorescences remain discrete, do not fuse together and many of them are petechial in character,

not fading on pressure. The rash is very distinctly visible and shows the richest development on wrists and palms of the hands, on the arms, the dorsum and soles of the feet and the legs, less on back and abdomen, the least on chest and face. A slight peeling occurs when the fever subsides. Brown pigmented spots, remainders of the rash, are visible—especially on hands and feet—for weeks or even months afterwards.

A moderate leucocytosis with a normal differential picture is a regular feature.

Weil-Felix test for OX19, OXK and OX2 was negative in these cases during the fever and the convalescence. Wassermann, Kahn and Kline reactions were sometimes positive at the height of the rash and became negative very soon in the convalescence.

Neill-Mooser reaction was positive in guinea-pigs injected with the blood of case 4.

Rickettsias have been found in the tunica vaginalis testis of the guinea-pigs that showed the Neill-Mooser reaction.

Vector: All patients lived in extremely close contact with rats.

#### *Discussion*

The diagnosis of endemic tropical typhus appears to be beyond doubt from the evidence reported, the clinical picture conforming with no other disease. In fact one of us (Heilig) reported cases 1, 2 and 3 and demonstrated case 4 as belonging to the group of 'endemic typhus', even before the confirmatory serological, animal inoculation or bacteriological findings, on pure clinical grounds alone\*.

A few days later one of us (Naidu) succeeded in producing the typical Neill-Mooser's reaction and demonstrated the Rickettsias in the guinea-pigs injected with the blood of case 4. The last case resembled so closely the other three in the clinical signs that the same diagnosis may be considered as established for them as well.

Megaw's ingenious classification of all known Rickettsioses according to the different vectors and Fletcher's discovery of the two distinct forms of typhus in the Malay States conveyed to man by two different vectors, makes one generally realize the great importance of the vector question for solving the puzzling typhus problem. In the louse and the mite-borne typhus the clinical symptoms are diagnostic of the vectors, while in the case of rat-flea and tick-typhus it seems to be more difficult. In our cases the diagnosis of louse-typhus was excluded on epidemiological, clinical and social grounds. The reported cases came from towns far apart, with no familial incidence. The patients were free from lice and nits, and belonged to a social class used to cleanliness. The rash did not appear on the 4th, as in the louse-typhus, but between the 8th and the 10th

\* Mysore Medical Association, 13th February, 1941.

day, the fever lasting longer than the typical period of a fortnight even in the mildest of these cases. There was no circulatory disturbance and the convalescence progressed much more quickly than in louse-typhus.

The mite-typhus cases have the characteristic signs of mite-bite in common: infiltration or even ulceration at the point of the bite and more-or-less painful regional lymphadenitis. None of these signs were present in our cases and in fact no cases of mite-typhus have been yet reported from South India. Some have been reported from Punjab (Yacob, 1937) and Burma (Martin and Anderson, 1933). There is no reason to assume that mite-typhus was among our cases.

The survey of literature of Indian typhus shows that apart from Yacob's (1937) cases (Punjab), the only vector established beyond doubt in India or suspected with good reasons is the tick, as reported by Megaw (1917), Megaw, Shettle and Roy (1925), Ghose (1928), Pai (1931), Mukerji (1932), Blewitt (1934), Sachs (1934), Stott (1935) and Shortt and D'Silva (1936). Others, Norman and Ramachandran (1925), Biggam (1932) in his excellent report of three cases observed in Bangalore and Macnamara (1935) could not trace the vector at all. Boyd (1935) analysed 110 cases reported from military stations in India in 1934, but in spite of the interesting results of his analysis he did not succeed in ascertaining the vector in more than a small minority of the reported cases. New ways of approaching the vector problem have been discussed by Napier (Editorial, 1936).

Our patients denied tick-bite definitely. No trace of tick-bite was seen on them and none of them had entered a jungle previous to the onset of the disease. Moreover, they differed clinically from those cases where tick-bite was ascertained as preceding the typhus; for these reasons we are unable to label the cases as 'tick-typhus'. There is however evidence strongly in favour of the rat-flea being the vector. The seasonal incidence (November to February), the non-epidemic character, the habitation in rat-infested houses, the presence of grain stores which harbour rats, are similar to the cases reported by Hone (1927), Fletcher and Lesslar (1925), in the Malay States, Maxey (1926), in the south-east United States and many others from Syria, Greece, Roumania, France, North Africa, China, Indo-China, South America, etc. The final discovery of Rickettsias in the rat-flea trapped in typhus areas (Baltimore and Savannah) by Dyer *et al.* (1932), thus confirm and close the diagnostic and epidemiological ring.

The presence of inguino-scrotal reaction in guinea-pigs (Neill, 1917; Mooser, 1929), the demonstration of Rickettsia bodies in the tunica vaginalis, and the absence of any brain lesion, are features strongly in favour of rat-flea typhus. It may be mentioned here that Neill-Mooser's

reaction with demonstration of Rickettsia bodies after the injection of patient's blood has not been previously described in India so far as we know, even though Covell (1936) had produced Neill-Mooser's reaction in his experimental investigations in Simla, and Goyal (1941) found (apparently non-pathogenic) Rickettsia bodies in rats in Calcutta.

Our investigations of rats trapped in our patients' houses have not yielded any definite results up to the present time. We hope to be successful at the time of or just preceding the local seasonal maximum incidence of typhus.

We do not want to review here the huge literature on the Weil-Felix reaction. We mention as important for our question the investigations of Spencer and Maxey (1930) and Felix and Rhodes (1931).

As the Weil-Felix reaction in our cases was negative for OX2, OXK and OX19, in spite of the fact that fresh antigen from Kasauli was used, we presume that a proteus-strain different from these three may be para-specific for this group. In this connection it is interesting to compare our cases with the groups classified by Boyd (*loc. cit.*). He used the agglutinated proteus-strain as the principle of classification. There is no doubt that our cases show resemblance with his OX2 group and the Ahmednagar-Poona type of the OX19 group in many respects. The late appearance of a very distinct rash, present in almost all Indian patients, its petechial character, its long duration and the remaining pigmented spots, its regular development on the limbs, on the palms of the hands and on the feet are clinical features, distinctly different from those in Boyd's OXK group and his other OX19 types (Bangalore group and mixed cases). These facts point towards an important relationship between his OX2-Ahmednagar-Poona cases and our observations. And in this combined group particularly the agglutinin titres are low and inconstant; co-agglutination far higher than in the other cases, so that Boyd assumes that neither OX2 nor OX19 are the main antigens of this group, but that the agglutination is only 'a group reaction to some other virus'.

There are many reports of a positive complement-fixation test (Wassermann reaction) in the epidemic louse-borne typhus; a similar feature is not uncommon in the Indian endemic typhus (Stott, Boyd and others). In all our cases either complement fixation, or flocculation, or both serological changes have been present, and they became negative early in the convalescence.

#### Summary

1. Four cases of endemic tropical typhus have been described.
2. The clinical picture of Mysore typhus is summarized.

(Concluded on next page)

## TRICHOSTRONGYLUS INFECTION IN MAN

By P. A. MAPLESTONE, D.S.O., D.Sc., M.B., B.S., D.T.M.  
(From the Helminthological Research Laboratory,  
School of Tropical Medicine, Calcutta)

INFECTION of man with certain species of the genus *Trichostrongylus* has been recorded in several parts of the world, including India, since it was first found by Looss in Egypt in 1895. As a rule the infection is uncommon and only a few worms appear to be present at a time. As far as I am aware, the worms never give rise to objectionable symptoms, so the infection is looked upon as of little more than scientific interest, and on this account it has not attracted the attention of medical practitioners, even in places where experience indicates that it might be fairly often encountered. But there are other

(Continued from previous page)

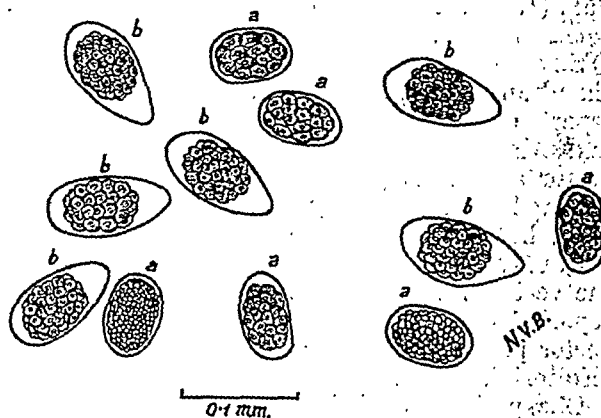
3. Positive Neill-Mooser reaction and presence of Rickettsia bodies are demonstrated.
4. The vector is most probably the rat-flea.
5. The reasons for the negative Weil-Felix reaction have been discussed.

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aspects of the subject than the above which render it of some practical importance.

It is very difficult and usually impossible to get rid of this infection by any known anthelmintic, so it has been stated by more than one worker that failure to distinguish the egg of these worms from those of hookworms will lead to a false impression of the value of an anthelmintic used against the latter worms. This is undoubtedly a point worthy of consideration but in my opinion there is another and still more important aspect of the matter from the practical point of view, and one of which I have had a good deal of personal experience. In the past few years, I have had a number of patients referred to me as suffering from an 'incurable hookworm infection' because they were still passing eggs after several treatments with recognized efficient hookworm drugs. All of these patients have been found to be passing a few eggs of a species of *Trichostrongylus*, but no hookworm eggs. The fact is that because



Camera lucida drawing showing six hookworm eggs a and six trichostrongylus eggs b.

their medical advisers failed to recognize the eggs these unfortunate people had been needlessly and ineffectively subjected to repeated treatments that are always objectionable and in the case of thymol, carbon tetrachloride and oil of chenopodium not without a certain degree of danger. The chance of this error arising has increased in the last few years because egg concentration methods are now much more widely employed than they were formerly in the diagnosis of intestinal helminthic infections, and these eggs, always few in number, are much more likely to be found now than when a plain faecal smear was used.

**Distribution in India.**—The worm appears to be widely prevalent in India and in some districts it is of fairly frequent occurrence, but the records are not generally known and are liable to be missed by the general reader because they nearly always appear in appendices or footnotes to survey reports dealing with commoner and more important intestinal helminths. The records given below show that the infection seems to have been found almost everywhere in India where large numbers of stools have been

PLATE XL  
 ENDEMIC TYPHUS IN MYSORE : R. HEILIG & V. R. NAIDU



Fig. 1.—Showing type rash : case 4.



Fig. 2.—Showing rash on the backs  
 of the hands and forearms :  
 case 4.

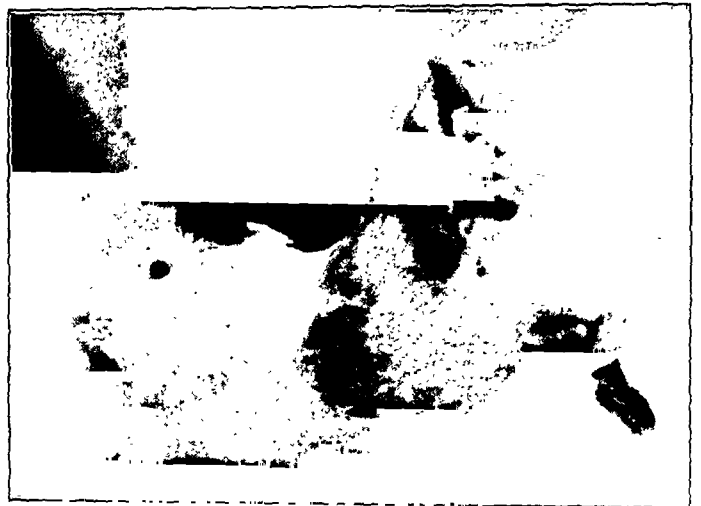
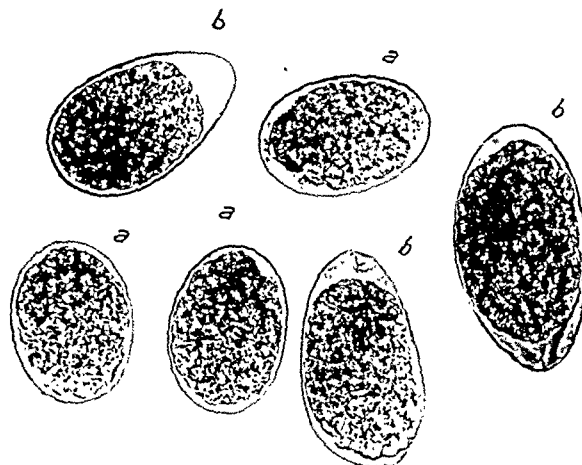


Fig. 3.—Neill-Mooser reaction.

*TRICHOSTRONGYLUS* INFECTION IN MAN:  
 P. A. MAPLESTONE



Photomicrograph showing three hookworm eggs and  
 three trichostrongylus eggs.



examined and the places are so far apart that it suggests that this infection is probably nearly, if not quite, as widely spread as hookworm infection.

Boulenger (1920) found 1.2 per cent of Indian hospital patients in Mesopotamia in the 1914-1918 war to be passing trichostrongyle eggs. He pointed out that the number of times he examined the stools of each man was too few to render it probable that he had discovered all the infections, and he estimated that his figure was probably no more than half the actual rate. As concentration methods were not then in use it seems that even his estimate of about 2.4 per cent would be too low. In an extensive survey throughout India, Chandler (1926 and 1927), using Lane's centrifuge technique, found ten per cent or more positives in several tea gardens in the Bengal Dooars, and he estimated the general infection rate for Bengal as a whole to be about 1 per cent. In Chota Nagpur he found only two cases, and in North-Western India about 1 per cent were infected. In Bombay Presidency the infection was widespread with rates varying between 1 per cent at Poona and 9 per cent at Dharwar in the south, and in Madras Presidency the rate was 0.5 per cent. In Mysore, Sweet (1929) using a simple salt flotation method recorded 0.4 per cent among his total examinations of over eleven thousand stools.

Since 1930 the figures for helminthological examinations of all cases have been published in the annual reports of the Calcutta School of Tropical Medicine and in the eleven years concerned 15,578 stools have been examined in in-patients and out-patients, and 173 trichostrongyle infections have been found, that is 1.1 per cent. Maplestone (1930) in a series of periodical examinations in two tea gardens in the Bengal Dooars found an infection rate varying between 9.1 and 25 per cent, depending on the season when the examinations were made, and in a special examination of fifty Europeans in the practice of a doctor in the same district I found five (10 per cent) infected.

There are no published records of the occurrence of *Trichostrongylus* in Assam, but in records of stool examinations done there some years ago, for other purposes than recording worm infection rates, I found the eggs of this worm twenty times in about two thousand examinations. Seven cases came from Upper Assam and the other thirteen from Sylhet Valley. In all this work D.C.F. was used.

**Helminthological considerations.**—The family *Trichostrongylidae* Leiper 1912 is an extremely large group of nematodes having genera or groups of genera with particular morphological characteristics, which parasitize practically all animals (sens. lat.) and as a general rule display a considerable degree of host specificity. Up to the present, several species of the genus *Trichostrongylus* Looss 1905 have been found in man but, with one possible exception, these

worms appear to be natural parasites of other mammals and only to parasitize man occasionally, in other words they differ from most of the worms in this family in not showing much host specificity. The exception is *T. orientalis* Jimbo 1914 as he described this species after finding it at 20 out of 45 *post mortems*, previously having seen the eggs in many stools and differentiated them from hookworm eggs (Jimbo, 1914). Three other species have been found in man and none of them seem to have very definite host specificity because, according to Looss (1905), *T. colubriiformis* (Giles, 1892) has been found in sheep, antelope, camel, monkey and man, *T. probulurus* (Railliet, 1896) in sheep, antelope, camel and man and *T. vitrinus* Looss 1905, in sheep, camel and man. Recently Maplestone and Bhaduri (1940) recorded *T. colubriiformis* six times in 100 dogs in Calcutta a fact which, taken in conjunction with the wide range of hosts listed above for this species, suggests the possibility that a more important factor in determining its host is the opportunity afforded to the larvæ of gaining entrance into any mammal rather than the type of mammal itself. There appear to be no records of identification of the species of *Trichostrongylus* living in man in India; all the reports given above refer to finding of eggs in the stools alone, but it is generally assumed that the species is *T. colubriiformis*, which was first described by Giles in India. I am inclined to agree with this general opinion because the egg measurements correspond fairly closely to those given in most textbooks for the eggs of this species, and it is very common in this country in its normal host, the sheep.

**Life history.**—According to Koino (1925), who worked with *T. orientalis*, the eggs hatch in a similar manner to hookworm eggs and after the second moult produce a sheathed infective larva in three or four days, at a suitable temperature. In experiments on mice he traced the migration of the larvæ and they seemed to follow the same route as hookworm larvæ do; he obtained penetration and migration to the lungs both by the oral route and through the skin; so it seems probable that human beings acquire trichostrongyles in the same manner as they acquire hookworms.

**Diagnosis.**—The differential points between trichostrongyle eggs and hookworm eggs are that trichostrongyle eggs are larger and have one pole distinctly more pointed than the other, much more like birds' eggs in shape than hookworm eggs which present a regular oval, both poles being equally broadly rounded.

The accompanying photomicrograph and scale drawing have been made from a preparation artificially prepared by mixing trichostrongyle eggs and hookworm eggs obtained from the stools of two different patients by D.C.F. and placed in water immediately, before the salt solution had had time to alter their contours.

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## SULPHANILYLGUANIDINE IN CHOLERA

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## Introductory

In the present study, an attempt has been made to evaluate the effect of sulphanilylguanidine in the treatment of cholera. This

(Continued from previous page)

It will be noticed that in the drawing all the trichostrongyle eggs clearly show that one pole of the egg is more pointed than the other, whereas in the photograph this character is not always so obvious. This is because in making a drawing it is possible to focus each egg separately and thus obtain an optical section of the shell passing through the most pointed part, but in taking a photograph some of the eggs are lying with their pointed ends either a little above or below the exact median horizontal plane so the end curve is somewhat broader and more nearly approximating to the contour of a hookworm egg, but even in these the difference in size is quite sufficient to render their identification easy.

Twenty hookworm eggs and twenty trichostrongyle eggs were measured in the same preparation as that from which the illustrations were made. The hookworm eggs varied between 66.2 and 57 $\mu$  in length and 42 by 38 $\mu$  in breadth with a mean of 62 by 40.8 $\mu$  and the trichostrongyle eggs varied between 96.5 and 80.2 $\mu$  in length by 55.3 and 42.4 $\mu$  in breadth, with a mean of 88.8 by 48.3 $\mu$ . These series of measurements may be taken as very fairly representative of the dimensions likely to be found in India for the eggs of these worms, but it is quite possible that the maximum and minimum figures may be occasionally exceeded. The differences both in shape and size of these eggs will be much more readily appreciated by a glance at the illustrations than by the written descriptions and measurements.

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compound was kindly supplied to us last December through the courtesy of Professor E. K. John Marshall, Jr. and the Calco Chemical Co., and of E. R. Squibb and Sons, New York, through their representatives in India.

Sulphanilylguanidine, for the sake of brevity called sulphaguanidine, is a sulfonamide derivative and is distinguished from allied compounds by reason of its solubility in water and low absorbability from the gastro-intestinal tract (Crossley, Northey and : : : : :). This causes it to remain in the intestines and to exert strong antibacterial effects. It is, therefore, likely to be beneficial in enteric infections such as acute bacillary dysentery, enteric fever, cholera and similar conditions. Marshall *et al.* (1940) found that the concentration of the drug was higher in the intestine than in the blood. In this respect it resembles those sulfonamide derivatives which act as urinary antiseptics.

*Toxicity and medicinal use.*—Studying the toxicity of the drug Marshall and Litchfield (1939) found that sulphaguanidine was less toxic than sulphapyridine in dogs. According to van Dyke, Greep, Rake and McKee (1939) 2 per cent sulphathiazole in diet was toxic for mice and produced certain pathological changes in the kidneys. This did not occur in Marshall's experiments even with 4 per cent sulphaguanidine. The penetration and distribution of sulphaguanidine in the tissues appear to be very similar to that of sulphanilamide and sulphapyridine.

Clinically sulphaguanidine has been found efficacious in bacillary dysentery.

*Clinical value in cholera.*—On the strength of the above properties sulphaguanidine was tried in the cholera ward of the Campbell Hospital. These results have been summarized in the table.

It is evident from the table that the results in cholera treated with the smaller doses of sulphaguanidine combined with saline, showed very little superiority over cases treated with intravenous saline alone. Cases treated with bigger doses of sulphaguanidine combined with saline therapy gave definitely better results, and the case mortality was reduced to 3.21 per cent. It is also interesting to note that of the three series of cases, studied above, the series treated with larger doses of sulphaguanidine required 3.32 pints of saline per patient whereas the average requirements of saline for patients treated with smaller doses of sulphaguanidine or with saline alone were 4.8 and 4.27 pints respectively.

The effects of the larger doses of sulphaguanidine on the frequency of stools were also investigated. It was noted that cases having both sulphaguanidine and saline had 5.24 and 3.73 stools per head on an average on the first and second days of treatment against 7.81 and

4.09 stools per head for similar periods of treatment with saline alone.

The effect of the larger doses of sulphaguanidine and saline in the anuric stage of cholera demonstrated that out of 117 cases 99 passed urine within 24 hours, 12 passed urine within 48 hours, 4 passed urine within 72 hours, and 2 patients died after 48 hours. Among 94 control cases (treated with saline alone), 81 were admitted with suppression of urine, out of which 12 passed no urine within 24 hours and the rest passed urine within 24 hours. Out of these 12 patients 6 passed urine within 48 hours and 2 passed urine within 72 hours, 4

the stools become fewer than 5 in 24 hours, 0.05 gm. per kg. is given every 8 hours. It is proposed to try this dosage during the next cholera epidemic.

#### Summary and conclusions

1. In a series of 218 cholera cases, sulphaguanidine 1 gm. initial dose, followed by 0.5 gm. six-hourly for 72 hours, has been found effectively to reduce the mortality. The mortality in control saline-treated cases (94) was 6.38 per cent, whereas the mortality in sulphaguanidine-treated cases was only 3.21 per cent. Sulpha-

TABLE

*The comparative value in cholera of different doses of sulphaguanidine combined with hypertonic saline on the one hand and saline therapy alone on the other hand*

Type of cases	SULPHAGUANIDINE: INITIAL DOSE 0.5 GM. MAINTENANCE DOSE 0.25 GM. EVERY 6 HOURS FOR 72 HOURS				SULPHAGUANIDINE: INITIAL DOSE 1 GM. MAINTENANCE DOSE 0.5 GM. EVERY 6 HOURS FOR 72 HOURS				CONTROL CASES WITH I. V. SALINE PERFUSION ONLY			
	Number treated	Number cured	Number dead	Mortality percentage	Number treated	Number cured	Number dead	Mortality percentage	Number treated	Number cured	Number dead	Mortality percentage
Culturally positive ..	26	25	1	3.84	54	52	2	3.70	67	61	6	8.97
Culturally negative ..	9	9	nil	0.00	42	42	nil	0.00	7	7	nil	0.00
Clinically positive ..	266	248	18	6.76	122	117	5	4.09	20	20	nil	0.00
TOTAL ..	301	282	19	6.31	218	211	7	3.21	94	88	6	6.38

died 72 hours after admission. It is thus obvious that larger doses of sulphaguanidine are definitely more effective than smaller doses.

It is realized that the doses of sulphaguanidine tried in both the series of cases were small compared to those that have been recommended subsequently for this drug. This was due to the fact that when the drug was received early in 1940, it was still in the experimental stage and proper dosage had not been worked out. Besides, in an acute infection such as cholera, we thought it would be advisable to try small doses to begin with in the interests of the patients.

Much larger doses of the drug have lately been recommended in the treatment of bacillary dysentery. The drug is administered according to a dosage of 0.1 gm. per kg. of body weight for the initial dose followed by 0.05 gm. per kg. every 4 hours as maintenance doses. When

guanidine is not toxic to human beings in these doses.

2. Sulphaguanidine-treated cases passed fewer stools per day and required less intravenous saline.

3. The percentage of deaths among culturally-positive cases, treated with large doses of sulphaguanidine, was 3.84, whereas among control culturally-positive cases of cholera, treated with saline transfusions only, this was 8.97.

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## A METHOD FOR ASCERTAINING THE OVERLAPPING OF THE PUBIS BY THE HEAD BY MEANS OF ABDOMINAL EXAMINATION ALONE\*

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and

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ANTENATAL supervision is now in general recognized as indispensable, and there is no civilized country, where it is not practised. One of the essential objects gained by it is the determination of the cephalo-pelvic relation soon enough to form beforehand a clear conception about the character and behaviour of the future labour. The cephalo-pelvic relation is made out by the engagement of the head. The latter can be determined by palpating the head at the brim, to know how far it has descended into the pelvis.

The other method for judging this relation is by ascertaining the height of the anterior shoulder above the top of the symphysis pubis. By palpation of the head at the pelvic brim, we can find out how much of the head is to be felt above the pelvic cavity, whether it is one-fourth, one-half or three-fourths, the rest of it at the same time being naturally in the cavity. When only one-fourth is felt above, the anterior shoulder is at the height of 2 inches from the pubis and the head has descended up to the ischial spines, and the greatest circumference of the head is in the pelvis. When half is made out above, the anterior shoulder is 3 inches from the pubis and the head has reached the mid-plane, and its greatest circumference is at the brim. When three-fourths of the head is distinguished above the brim, the anterior shoulder measures 4 inches from the top of the pubis and the head is just entering the pelvis, the greatest circumference being naturally above the brim. When not entering the brim, the whole head is free above it and can be readily moved from side to side. The anterior shoulder is then from  $4\frac{1}{2}$  to 5 inches high. The head is, under the circumstances, also said to be floating. When in this condition, it is to be seen whether it can be made to enter the pelvis.

In a multipara who has had several successive pregnancies, whose uterine wall as well as abdominal wall might have lost its tone, and in whom the foetal head might not have been pressed down into the brim, the head thus situated might be made to engage the pelvis by exerting pressure on it by both hands and pushing it down towards the brim. Should it not enter, there is disproportion between the head and the pelvis; either the head may be larger or the pelvis smaller than the average. As a rule, except when the head is exceptionally large, as in hydrocephalus, the large size of the

head in itself very seldom offers hindrance to its descent into the pelvis. This can be proved by the fact that the head is not infrequently delivered in the persistent occipito-posterior position even though its occipito-frontal diameter, measuring  $4\frac{1}{2}$  inches, is lying first across the pelvis and later in the antero-posterior diameter of the outlet. Usually in the normal occipito-anterior position, undergoing normal mechanism, the engaging diameter is suboccipito-frontal, which is  $3\frac{3}{4}$  inches and is therefore  $\frac{1}{4}$  inch smaller, whereas with  $4\frac{1}{2}$  inches of the occipito-frontal diameter, the circumference of the head filling up the birth-canal is comparatively very much larger; yet the delivery is not uncommonly effected normally.

This proves that moderate increase in size of the head does not much matter, whereas diminution in the size of the pelvis does raise a material obstacle. Besides diminution in size of the pelvis, other causes preventing the entrance of the head into the pelvis are placenta prævia, obliquity of the uterus, feebleness of the uterine wall due to successive pregnancies at short intervals, great thickness of the extraperitoneal fat and of the abdominal wall, and development of the placenta in connection with the anterior wall of the uterus; and also malpresentation of the child, such as face or brow presentation. Excepting these conditions, the head has more often than not entered the brim in due time.

When the head has not gone down the brim and also it cannot be pushed into it, there might be disproportion. With this the head would be felt overlapping the symphysis pubis. This overlapping may be slight, moderate or great.

To ascertain whether the head can be made to enter or not, and if not, how much it overlaps the pubis, the method which is most commonly used and gives the greatest help is the one advocated by Muller and Munro-Kerr. To carry out examination by this method, the patient is placed on her back in the ordinary gynaecological position. Two fingers are introduced into the vagina, while the thumb is made to rest on the top of the pubis. An assistant is then asked to make pressure on the fundus, when the fingers in the vagina will note whether the head descends into the cavity and to what extent. If it does not descend, the thumb above the pubis will perceive how much it overlaps the pubis. But in this method as the fingers are inserted in the vagina, there is every chance of conveying infection there. Secondly, an examiner with small hands often finds it difficult to reach the top of the pubis, especially when the index and the middle fingers are simultaneously in the vagina. To deal with these conditions successfully a method has been devised. It gives almost precise information. We have both been practising it for some time now and have found it useful. It is carried out as follows.

The patient is first placed on the examination table in the dorsal position, to ascertain that the

\* Read at the Third Obstetric and Gynaecological Congress at Calcutta in April 1941.

head is floating. Then the patient is moved down so as to bring the buttocks over the edge of the table. The examiner now stands in front of the buttocks and with the fingers of his right hand locates the top of the symphysis pubis and rests them above it. The patient is then put in the exaggerated lithotomy position, the thighs being separated and completely flexed on the abdomen (figure 1). Should the head be felt to descend through the brim, the fingers will notice it, especially by feeling the surface of the head behind the vertical plane of the

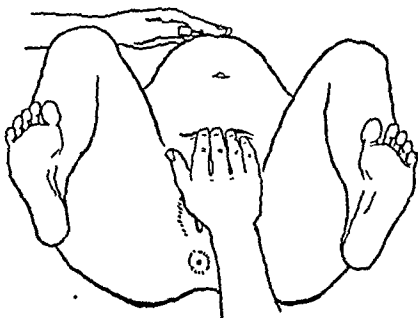


Fig. 1.

posterior or internal surface of the symphysis pubis (figure 2). To facilitate the recognition of the descent of the head, the assistant may be asked to press on the fundus, when the



Fig. 2.

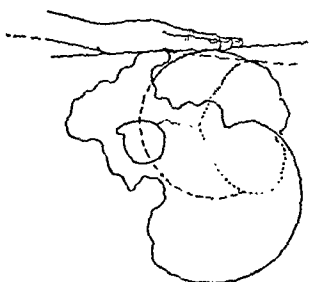


Fig. 3.

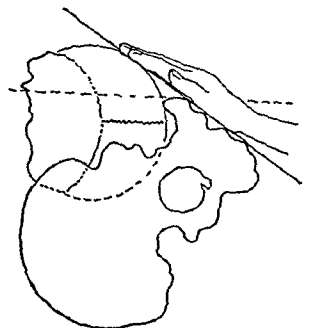


Fig. 4.

As long as the surface of the head lies behind the

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## DYSTOCIAS DUE TO ANOMALIES OF THE FŒTUS ASSOCIATED WITH DILATATION OF THE FŒTAL URINARY BLADDER

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During the past ten years three cases of marked dystocia, due to dilatation of the fetal urinary bladder, have come under my care.

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vertical plane of the anterior surface of the pubis the overlapping is slight (figure 3). But when the prominence exceeds this limit and is felt to project beyond the anterior surface, the overlapping is great (figure 4). Determination of this condition is of practical importance because, so long as the overlapping is slight, there is every probability of the head engaging the cavity by undergoing safe moulding.

As the patient is placed with thighs flexed on the abdomen, the abdominal muscles are relaxed, and they allow of the head being readily felt. Furthermore, the pelvis, which, when a person stands, becomes tilted downwards and forwards, has its inclination reduced, when she lies on her back and her thighs are bent on the abdomen, its brim thereby coming to look upwards. With this the head is brought in a line with the middle of the pelvic brim, thus enabling it easily to occupy the inlet.

This mode of examination possesses certain advantages which are set forth below.

(1) The examination can be carried out readily at the outdoor or consultation rooms without much preparation of, or any inconvenience to, the patient.

(2) There is no need to introduce fingers into the vagina, thus creating no occasion to introduce sepsis.

(3) The examination can be done by this way every week in the last month of pregnancy, when the head is floating.

(4) Even in a multipara it helps to ascertain whether the head can be made to enter the brim.

(5) In slight disproportion, if induction of premature labour is contemplated, this method will indicate the time when it should be done.

(6) As the hand is held flat on the symphysis pubis with the fingers pointing towards the head, it can perceive more precisely the amount of overlapping, whether slight or excessive. This information obtained is of practical importance because, when it is slight, spontaneous delivery by the natural passages may be anticipated, but when excessive, Cæsarean section at term is at once indicated.

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All have presented considerable risk to the mother. This is a large number of so rare an anomaly to come into the experience of one obstetrician. I desire to present my experiences with these cases that others may profit by them, particularly because, when the diagnosis is made early, the obstetrical problem is much simplified. The mother then can be saved from the danger of a long labour that can only result in her exhaustion and will avail her child nothing. I therefore feel justified in presenting these cases from memory, even though they may lack some scientific detail which I would have wished to give.

### Case reports

(i) The first case was that of a woman of about 33 years, seen in the Harborview Hospital of the King County Hospitals of Seattle, Washington, U.S.A., during the spring of 1931. She was a gravida II, the first child, eight years of age, had been delivered normally. From the onset of the second pregnancy, the patient had been ill and had, at the time I first saw her, been in hospital for some time for a severe anaemia, questionably primary. The serological test for syphilis was negative. I recall certain prenatal findings which should have caused all of us connected with this case to suspect some such abnormality as was found at delivery. These were—(i) enlargement of the abdomen beyond the expected size for the period of gestation; (ii) the presence of the foetal head high up under the right maternal costal margin; (iii) the tension and globular enlargement of the lower half of the tumour of pregnancy.

At about the end of the seventh month of gestation, while she was being treated for a severe infection due to *Trichomonas vaginalis* by scrubbing the vagina, an unevenness of the cervical outline was palpated. This had not been present the preceding day at the time of treatment. A direct view of the cervix by speculum revealed the toes of one foot protruding through the long, rather hard cervix, dilated just enough to admit them to the external os.

The condition was reported immediately to the visiting staff obstetrician, who advised waiting till evening for pains to begin. Labour set in spontaneously late in the afternoon. From the first the pains were very distressing to the patient. The cervix softened and dilated almost completely, but the presenting parts failed to advance. At about midnight, the visiting staff obstetrician arrived and under his direction an attempt was made to effect delivery by bringing down the other foot. Traction was applied to both feet but the body failed to move. A contraction ring was considered to be the cause of obstruction. An episiotomy had been done to facilitate manipulation. Further traction, to the point of undue stress on the knee joints, was without effect. The patient was returned to bed with traction applied to the foetal limbs by way of a pulley over the foot of the bed and a strong sedative was given. By early morning no progress whatever in the descent of the foetus had been made. An x-ray was taken in the hope of demonstrating some abnormality of the foetus. The writer (the roentgenologist was not present at the time) thought that there was marked increase in the distance between the crest of the foetal ilium and the lower margin of the thoracic cage, which also seemed shortened and broadened. This was interpreted to mean that some abdominal tumour was pressing upwards flattening the thoracic cage in its longitudinal direction and broadening it in the anterior-posterior and transverse directions. The arms were raised to a level with the shoulder and the head was pressed far to the maternal right. This diagnosis was not then concurred in by either the senior visiting obstetrician

or the roentgenologist who later examined the film without knowledge of the clinical findings at delivery.

The patient's predelivery response to anti-anaemic treatment had not been satisfactory. Her condition became such that it was thought advisable to give her a transfusion before any further attempt at delivery should be made. Accordingly a transfusion, previously arranged for, was immediately given. The uterine contraction ring had now relaxed permitting the examination of the enlarged foetal abdomen to confirm the diagnosis. An incision was made above the foetal symphysis releasing a large amount of clear fluid and permitting a very easy delivery of a still-born premature child. The patient made an uneventful recovery except for a small localized stitch infection.

*Pathological findings.*—The foetal ribs flared outwards. The length of the thoracic cage was greatly shortened and the transverse diameter was relatively and probably actually greater than the longitudinal. Both legs had been dislocated at the knees. The abdominal wall was very wrinkled and the umbilicus showed evidence of great stretching. All abdominal organs were much compressed. The cloaca had not differentiated, the urogenital fold was incompletely formed. The urachus was enormously dilated forming a large cone stretching up towards the umbilicus. The gastro-intestinal tract was in a primitive stage of development, being almost a straight piece, long enough to reach from the diaphragm to the cloaca. The stomach was partly differentiated, and Meckel's diverticulum still attached the mid-gut to the umbilicus. The rectum, or rather cloaca, was imperforate. The external genitalia were very poorly developed. The ureters were patent and joined to the primitive cloaca. The penis was very small, the halves of the scrotum almost completely separated and the testicles undescended. I do not recall whether or not the urethra was patent. I have an imperfect remembrance that the kidneys were of the horse-shoe type.

(ii) The second case was that of a young primigravida who was admitted to the Frances Newton Hospital, Ferozepur, Punjab, in labour, in the spring of 1932. Physical examination showed a very anaemic young woman, about 18 years of age. The size of the uterus indicated a gestation of about thirty weeks. The lower half of the uterus seemed globular, distended and tense. The foetal limbs could be palpated easily in the fundus uteri. The vulva was in an indescribable state owing to a syphilitic lesion which occupied the fourchette extending 3.5 to 4 cm. up each side and about 3 cm. in the other direction. The edges were raised and hard, the base granulated and angry looking. The whole was bathed in a creamy pus flowing from the vagina. The probability of a foetal anomaly of this sort was immediately recognized. But the reluctance, both for the patient's sake and the doctor's, to undertake any surgical procedure can well be imagined. There obviously was no disproportion between the foetal head and the maternal pelvis, for the head came down and then receded with each pain. Soon it became evident that some surgical procedure could not be avoided, so the foetal thoracic cage was entered, and the diaphragm and then the distended bladder punctured. The remainder of the delivery was accomplished with ease. The lesion of the fourchette was very friable and inelastic. A laceration through this was inevitable. The whole lesion was excised and a repair done. This broke down in spite of vigorous anti-syphilitic treatment and a severe local and general sepsis ensued. Unfortunately our present-day chemotherapeutic armamentarium was not then available. At the end of a month, when we were despairing of her life, we gave her family permission to remove her to her village home. Two weeks later they returned for medicine, reporting great improvement.

This foetus was also a male. As I recall, the gastro-intestinal tract was much better formed in this case. The kidneys and the ureters appeared normal. The bladder and rectum were both completely formed though the bladder was enormously dilated. The external genitalia were poorly formed, the penis very

short, and the two halves of the scrotum separated by a deep cleft. The testicles were undescended.

(iii) The third case, a multipara, V or VI gravida, I do not accurately remember which, was admitted to the Mrs. Anson Hospital, Balrampur Estate, Gonda District, United Provinces, in the spring of 1938. She came to the hospital at about noon one day, having been in labour three days. One darkly discoloured foetal extremity, disjoined at the knee, and with part of the skin pulled off, hung from the swollen vagina. An untrained *dai* had delivered the extremity and exerted traction on it, but had failed to deliver the other foot. The characteristic shape of the uterus, globular and very tense in its lower half and comparatively relaxed in the fundal portion, along with the history of the labour, immediately suggested the diagnosis. Intra-uterine palpation of the foetal abdomen showed it to be very tense and distended. An incision into this released a considerable amount of clear fluid, allowing easy completion of the delivery. The patient and her mother, who accompanied her, maintained that the pregnancy was full term. It was well into the eighth month. Previous deliveries had all been normal.

The patient's condition at the time of delivery was generally satisfactory and the puerperium was entirely uneventful. Her Kahn test was negative.

An interesting incident occurred, illustrative of the poor development of the external genitalia. The patient's mother insisted on seeing the foetus. Her expression of amazement was most interesting as she exclaimed that this was truly neither male nor female! The penis was very short and the scrotum so deeply cleft that it was indeed difficult to determine the sex on a cursory examination. The urachus was widely dilated forming a coned-shaped top to the bladder. The ureters and kidneys appeared about normal. The gastro-intestinal tract, heart, lungs, liver, spleen and kidneys were apparently not abnormal. This, as with the other two, showed a characteristic shortening of the thoracic cage and flaring outwards of the ribs.

### Discussion

Such cases have certain features in common which should make the alert obstetrician able to diagnose the condition; so that, after complete dilatation of the cervix, the technically very easy surgical procedure could be carried out before the mother is allowed to become exhausted. The only consideration in these cases is the well-being of the mother, for the prognosis for the child is fatal. Brothers (1896) states, 'The prognosis for the child is fatal, only one child having reached the age of five days'. The surgical procedure is of course somewhat simplified if the feet are presenting, as was the situation in two of my cases. In these three cases there is not much in common from the maternal point of view, except the obstruction to labour due to the foetal abnormality.

Only a limited amount of literature has been available to me. However I have combined the information accumulated from these three cases with that gleaned from the reports of seven other cases I have been able to find in the literature available to me. I have summarized these cases in regard to certain facts in the history and physical findings, both of the mother and the foetus, as follows:—

1. All patients were between the ages of 18 and 35.

2. Three were gravida I, one gravida II, one gravida III and the remaining five were gravida IV to VII.

3. Associated diseases: A history of syphilis with positive serological reaction is recorded in only one case. A maternal negative and a paternal positive serological reaction is reported in another case in which the mother had previously delivered six still-born children. One other report states that there was no sign of syphilis or tuberculosis. My other two cases were serologically negative for syphilis. Six other reports do not mention the disease.

One patient is known to have had albuminuria and another (mine) a severe anæmia, resistant to treatment before delivery. She also had a *Trichomonas vaginalis* infection.

4. Nine of the ten foetuses were males.

5. All were premature, varying from six to eight and a half months' gestation.

6. Seven were vertex presentations. One case was probably vertex though the position was not specifically mentioned. Two of my cases were foot presentations.

7. The shortest labour mentioned was ten and a half hours. Only one terminated without surgical interference, i.e., puncturing the bladder. That child lived sixteen days, the only case in this series to survive delivery. One other case, not in this series, is reported to have lived five days, but no mention is made of any surgical interference in the delivery.

8. Two of these cases had demonstrable obstruction of the urethra, one demonstrated by serial section. Some were definitely not obstructed. Obstruction cannot therefore be given as the cause of foetal bladder distension.

9. The method of delivery in nine out of ten of these cases was by puncturing of the foetal bladder. Deliveries were uniformly easy after this procedure.

10. Maternal post-partum progress was good in every case not seriously otherwise complicated. My second patient was the single exception. Her morbidity was marked owing to a secondarily infected syphilitic lesion of the fourchette, which had been present at the time of delivery.

11. Foetal prognosis is uniformly fatal. No survival seems to have been reported in this or any other list. I find mention of only two cases surviving delivery even a few days.

Jeffcoate (1931), summarizing the literature, says that the condition is comparatively rare, and quotes Goldberger as saying that, up to 1929, 217 cases had been reported but does not state whether dystocia was present in all. Jeffcoate further states that it has occurred usually in primigravida or in the early child-bearing period and that labour has often been premature. There was cephalic presentation in most of the cases. The children affected have



been mostly males. Foetal ascites has been a frequent association. Other abnormalities have usually been present, the most common being spina bifida, talipes, imperforate anus, and mal-development of the genitalia.

The outstanding differences in this group of ten is that the majority were not in primigravida and at least four of the ten occurred in the ages between 30 to 40, so that there is no majority even for the early child-bearing age. No case of spina bifida was present in the group.

In this group the malformations of the foetus are listed in the order of their frequency: dilatation of the bladder, with some degree of dilatation of the ureters and hydronephrosis in most cases, malformation of the external genitalia, talipes equinum varum, compression of the thoracic cage, imperforate anus sometimes associated with primitive cloaca, and, in one case, with an entire digestive tract in a primitive state of development.

There seems to have been a general tendency in the literature to regard the condition to be the result of an obstruction in the urethra. Jeffcoate (1931) points out that there have been reports of cases in which no obstruction of the urethra could be demonstrated, to account for the hypertrophy and dilatation of the bladder. He suggests that, in the group of cases in which there is no obstruction of the urethra, the underlying mechanism lies in the failure of proper development of the neuro-muscular system. To me this or some such explanation seems the most reasonable one in both of the groups in which urethral obstruction can be proved and those in which it is proved not to be present. I make this comment in the hope that someone coming on such a case may be able to study the neuro-muscular or even the central nervous system of one such case.

#### Conclusions

1. The condition of distended foetal bladder, sufficient to cause dystocia, can be diagnosed before delivery.
2. The surgical procedure on the foetus is comparatively simple.
3. Only the maternal welfare should be considered in dealing with these cases. The prognosis for the mother is good in otherwise uncomplicated cases.
4. The prognosis for the foetus is uniformly fatal.
5. Foetuses have some other anatomical abnormality of a serious nature.

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## DEVELOPMENTAL ANOMALIES OF KIDNEY AND URETER

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THE stages of development of the urinary system prove that the higher vertebrates are descendants of the ancestors of lower forms. The functioning kidney in higher vertebrates is evolved out of three renal systems. Evidence is found in the same individual of the formation of the simple kidney, retrogression of the same and the appearance of a complicated one in its place. The pro-nephros, the simplest renal organ (functioning kidney in tadpole), originates at the 3rd week of foetal life, in the lower cervical and in the upper dorsal region. Most of its elements retrogress and are replaced by the meso-nephros-thoracic kidney (the final functioning kidney in fish). The meta-nephros, the final functioning kidney in mammalia, is evolved in two parts, (a) the transporting tubular system develops from the ureteric bud of the meso-nephric duct and (b) the secretory system, from the intermediate mesodermic cell mass of the nephrogenic cord.

The meso-nephric duct (Wollfian duct) is utilized in the male as the transporting channel for sperms, while in the female it remains as a vestigial structure (Gartner's duct). At the third month the meta-nephros is fully formed and is found at the level of the 4th or 5th lumbar vertebrae. Permanent higher position is reached at the fifth month.

#### Anomalies of the kidney

1. *In position.* Congenital ectopic kidney in the pelvis or lumbar region, same side or crossed.
2. *In structure.* Rudimentary atrophied or hypotrophied, cystic (single or multiple).
3. *In number.* Absence of one or both. Supernumerary kidney.
4. *In shape.* Horse-shoe, disc, 'S' shaped, or mass multi-lobular kidney.
5. *In blood supply.* Single aortic renal artery, bifurcating. Multiple aortic renal arteries. Renal artery originating from common iliac, inferior mesenteric, middle sacral, etc.

The mode of entrance of the artery into the kidney may be anomalous in relation to the renal vein or ureter. An aberrant branch may pass directly to the lower or the upper pole of the kidney.

#### Anomalies of the renal pelvis

1. *In number.* Duplication of the pelvis.
2. *In form.* Cystic pelvis.

Abnormal position or shape subject the kidney to (a) Trauma. (b) Tumour formation. (c) Infection, including tuberculous. (d) Calculus formation. (e) Hydronephrosis.

The following is an example of hydronephrosis in an ectopic kidney :—

*Case 1.*—Hindu female, single, aged 12 years, was admitted to hospital suffering from a painful suprapubic tumour of 6 months' duration on the right side. There was also a history of intermittent polyuria. Routine examination eliminated such conditions as ovarian cyst, or soft uterine fibroid. The diagnosis appeared to lie between a mesenteric cyst or lesion of the right kidney. Operation was advised and undertaken, when a huge right-sided hydronephrotic cyst filling up the right side of the pelvis and iliac fossa was discovered. Any effort to isolate and remove such a cyst would have taken a very long time if indeed it would have been possible. The patient began to show signs of distress under the anaesthetic, so the cyst was merely drained and marsupialized, and the patient returned to bed as soon as possible. She had a very stormy convalescence, and unfortunately the cyst became secondarily infected. When this subsided, a second series of skiagrams was taken, and as a result the patient was again operated upon, and this time we found the cyst and kidney at the level of 5th lumbar vertebrae and ala of sacrum with a narrow ureter issuing from its lower pole. The whole was removed with as much of the dependent ureter, as possible. Unfortunately the patient died during convalescence.

The following is a complete x-ray note which describes the radiological appearance very fully and our thanks are due to Dr. G. Galstaun for his interesting report:—

The opaque medium was seen to fill a series of large sacs lying at the level of the ilia and immediately anterior to the lumbo-sacro junction.

The outline of the sacs do not suggest that of the colon. They rather suggest the appearance of ectopic cystic kidney.

*Note.*—A plain skiagram of the renal area is advised in order to determine whether the normal renal outlines are present.

(The above is a description of the appearance after the abdominal sinus was injected with sodium iodide solution.)

*Skiagram. Part examined—urinary tract. Position—posterior.*

The shadow of the left kidney is clearly seen. It appears normal in shape, size and position.

In the renal area is seen an irregular shadow, which does not have the clear-cut outline associated with a kidney. On closer examination this shadow presents an appearance of hausturation. Its limits too are somewhat higher than those of the left kidney.

The psoas shadow on the right side presents unusual appearances. At the level of the 3rd lumbar vertebrae it bulges markedly to the right side, the limits of the bulge being more than one inch lateral to that of the psoas shadow on the opposite side. The lower portion of this shadow is slightly more opaque than the opposite psoas. No calculus shadow is seen in the urinary tract.

*Conclusions.*—Appearances suggest the following:—

(1) The right kidney would appear to be absent from its normal position in the loin.

(2) The apparent bulge in the psoas shadow seen on the right side might be due to an ectopic kidney.

Pyelography is indicated, preferably retrograde pyelography, on the right side.

(3) *Date 14th February, 1941. Skiagram. Part examined—urinary tract. Intravenous pyelography. Position—posterior.*

The filling up of the left kidney at 5 minutes is normal. The outline of the renal pelvis is normal and the calyces show normal cupping. The right renal region shows no evidence of any contrast medium. The bulge in the outline of the right psoas muscle previously

noted is again seen. Irregular splodges of contrast material are seen here.

*At 15 minutes after injection.* The splodges previously noted have increased in area, a large saccular shadow being seen immediately lateral to the right sacro-iliac synchondrosis.

*30 and 60 minutes after injection.* Filling of the left kidney persists. The shadows on the right side are still seen. They do not present the same discrete outline as those noted in the last series where an injection of sodium iodide was made into the sinus.

*Conclusions.*—The appearances tend to confirm the diagnosis of ectopic kidney on the right side.

(4) *Date 7th March, 1941. Skiagram. Part examined—urinary tract. Retrograde pyelography. Position—posterior.*

The appearances are exactly similar to those seen at the examination on 7th February, 1941, i.e., those of an ectopic cystic kidney on the right side. The ureteric catheter passing into the substance of the mass.

### *Anomalies of the ureter*

1. *In number.* Duplication throughout, or bifurcated above or below.

2. *In form.* Short or elongated or tortuous narrow or dilated (megalo-ureter).

3. Abnormal position of opening into bladder.

4. Opening into abnormal structures such as urethra, vagina, rectum, seminal vesicles or perineal region.

Abnormal opening such as into urethra, rectum, seminal vesicle or perineum needs no explanation. Opening of the ureter into vagina is difficult to explain. The vaginal cord evolves out of the Mullerian epithelial lining. Gradually it hollows out forming the vagina. The vagina is fully formed by the breaking down of the epithelial cord in the fifth month of foetal life (Keith). The urethral bud comes out of the meso-nephric duct at the sixth week, and the final kidney is fully formed by the third month. The termination of the ureter must have by this time been determined, so the uretero-vaginal fistula (congenital) is difficult to explain developmentally. No case has so far been described.

The following is an interesting case of congenital uretero-vaginal fistula (unilateral) :—

*Case 2.*—Muslim female, single, aged 11 years. Admitted for continuous dribbling of urine from the vagina since birth. However, in addition to this dribbling the girl was able to pass urine in a normal manner per urethram at regular intervals.

On examination, the left kidney could easily be palpated and was obviously hypertrophied. The right kidney region seemed empty. Intravenous pyelography showed a large left kidney and ureter; the right kidney and ureter were not visualized. Cystoscopic examination was then done, and while the orifice of the left ureter was seen with ease, the right orifice was not seen. Not even a dimple in the wall of the bladder, where the orifice of the right ureter should have been, could be made out.

*Per vaginam.* The vaginal mucous membrane high up on the right side was arranged in the form of a fold close to the right side of the cervix uteri. The urine was dribbling from behind this fold, but no actual hole could be seen.

The diagnosis was not completely apparent. Either the condition was one of absence of right kidney with double or bifurcated left ureter, one branch of which was opening into the vagina, or of rudimentary right, probably ectopic kidney with small abnormally placed ureter opening into the vagina. The patient was operated upon. On opening the abdomen, and incising the posterior peritoneum, the right ureter, a narrow

(Concluded on next page)

## ARSENIC IN FOOD

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A COMPREHENSIVE idea of the arsenic content of common foodstuffs is of much importance in forensic toxicology. In cases of suspected arsenic poisoning the stomach contents, if analysed quantitatively for determination of arsenic, give the total amount of arsenic present in the stomach, but, unless the normal arsenic content of foods are known, it will not be possible for the analyst to express a definite opinion as to the amount of extraneous arsenic administered, either accidentally or with a criminal purpose. In fatal cases, when a large quantity of arsenic is found in the stomach or in the viscera, no difficulty arises in giving any such opinion, but in those cases, both fatal and non-fatal, in which a small quantity of arsenic is detected in the stomach, all sorts of complications arise, and in such cases it may be contended by the defence that the amount of arsenic found in the stomach might legitimately come from the food substances which were taken by the victim and was not of any criminal origin. To eliminate such difficulties in chemico-legal work, an investigation on arsenic in food was taken up in 1934 and a preliminary report was published in the *Indian Science Congress Proceedings* (Bagchi and Bose, 1935). Another short and premature report was also published in the *Indian Journal of Medical Research* by one of our co-workers (Bose, 1935). This piece

(Continued from previous page)

structure, was identified at the pelvic brim and was followed up to a rudimentary ectopic kidney ( $1\frac{1}{2} \times 1 \times \frac{3}{4}$  inch) at the level of 5th lumbar vertebra. The ureter was seen issuing out of its lower pole, and a group of small blood vessels entered at its upper pole. The kidney with available part of the ureter was removed. The ureter was not traced downwards, the lower part being merely ligated. The dribbling of urine immediately ceased, and as soon as the patient recovered from the anaesthetic, there were no symptoms at all, and she left hospital perfectly fit. In addition the patient had a developmental error in the lumbosacral spine.

The case was therefore one of infantile kidney, a very rare anomaly (Da Costa) together with an abnormally placed ureter, the latter opening into the vaginal vault behind the fold of tissue referred to in the description.

The correlation of the clinical findings in this patient was not the least interesting feature of this interesting case. Anomalies of the kidney and of the ureter are rare, and therefore a case such as the above which displayed a developmental defect in both these organs is of special interest.

of work could not, however, be completed on account of some unforeseen circumstances and had to be discontinued in 1935.

The method adopted for determination of arsenic was that of Marsh-Berzelius modified by Chapman (1926). The quality of zinc required for this extremely delicate method could not always be obtained. Some of the specimens of zinc manufactured by Merck or Kahlbaum were not absolutely arsenic-free, as claimed by them, and some did not even give the typical mirror of arsenic. The standard mirrors prepared from a particular sample of zinc were sometimes found to vary widely from those prepared from another sample of the same manufacturer or of a different manufacturer. This phenomenon was obviously responsible for some erratic results detected later on in the arsenic figures of some of the foodstuffs, which were published in the preliminary notes referred to above. The sensitization of zinc by cadmium sulphate, as recommended by Chapman (*loc. cit.*), did not always succeed in getting rid of this discrepancy, and it was found necessary to prepare standard mirrors with every new packet of zinc. As this procedure involved much hard work and waste of time, it had to be given up as an unworkable proposition. The Marsh-Berzelius method was therefore abandoned in favour of the Gutzeit method. The difference in quality of the samples of zinc did not matter in the least in this method, as the standards were prepared every day for matching against the unknowns. Being less time-consuming, and easier and cheaper, the Gutzeit method, as recommended by the *British Pharmacopæia* (1932) and further improved upon by Davies and Maltby (1936) and the Association of Official Agricultural Chemists (1936), proved satisfactory for this purpose, as indicated by duplicate experiments and recovery of added quantities of arsenic from control tests. By this method, we carried out successfully our first investigation on the arsenic content of human tissues and excreta (Bagchi and Ganguly, 1937).

The next attempt to complete the investigation on arsenic in food was made under the auspices of the Indian Research Fund Association, and the work was taken up in 1939 employing the modified Gutzeit method for determination of arsenic. The preliminary oxidation of organic matter to liberate arsenic from its organic compounds was effected by means of concentrated nitric and sulphuric acids, as worked out by Ramberg (quoted by Cox, 1925). As this investigation was continued *pari passu* with that on lead in food, the technique of cleansing the samples of foodstuff from dust and other sources of contamination, as described in detail in a previous communication (Bagchi *et al.*, 1940), was as perfect as could be managed under the conditions of the experiments. Two samples of each kind of food, collected from two different sources,

were put to analysis. If the results were identical in both the tests or only slightly different, one figure giving the mean of the two was recorded. In cases giving widely divergent figures, both the results were shown and in such cases the results were confirmed by repeating the tests to eliminate the possibilities of experimental errors and contamination. All food substances were submitted to analysis in their fresh form, that is, in the condition in which they are usually taken or cooked. In the case of dried fruits and nuts, which are usually full of dust, care was taken in washing them in running water for several minutes and then drying them in the sun to their original weight before they were finally weighed for actual determination.

About 100 different articles of food and drink were analysed, the results of which have been classified and shown in the appendix. It has been observed that foods belonging to the vegetable kingdom are exceedingly poor in arsenic, while those belonging to the animal kingdom contain the maximum amounts of arsenic. In fact, no animal food in our list was found free from arsenic, while no arsenic was detected in as many as 21 out of 60 food-stuffs of vegetable origin. The denizens of the sea, *e.g.*, the sea-fish, are fairly rich, whereas the terrestrial animals and those living in the rivers are comparatively poor in arsenic. It is interesting to note that hilsa fish, although they are netted in the rivers of Bengal, appear to belong, on account of their high arsenic content (3 to 4 mg. of  $\text{As}_2\text{O}_3$  per kilo.), to the class of sea-fish. The zoologists or rather the piscatologists may make a note of this fact which is likely to lend additional weight to their observation that the hilsa is a denizen of the sea. The piscivorous people of Bengal, on the other hand, should take it as a warning against eating too much of this fish, although the amount of  $\text{As}_2\text{O}_3$  (1/40 of a grain per pound of edible portion) is well within the dose (1/64-1/16 grain) prescribed by the *British Pharmacopæia*.

It is believed that some prawns are very rich in arsenic and in fact, in one specimen (a sea-water prawn from the London market), Chapman (*loc. cit.*) obtained 1.2 grains of  $\text{As}_2\text{O}_3$  per pound of its edible portion (or 174 mg. per kilo.). This finding was, however, not confirmed by any other worker in this line. In our investigation, all the samples of lobsters were procured in Calcutta and all of them were of fresh-water origin, and the maximum amount of  $\text{As}_2\text{O}_3$  that could be obtained was 1.70 mg. per kilo. This figure is undoubtedly much higher than that of any of the fresh-water fish we examined, but is insignificant in comparison with Chapman's figure. It is likely that marine prawns or lobsters may contain much larger quantities of arsenic, so as to produce a mild form of arsenic poisoning, as pointed out by Chapman. It is not unusual for a man to eat a pound of lobster and if the

specimen happens to contain about a grain of arsenic ( $\text{As}_2\text{O}_3$ ) per pound, it will almost certainly produce gastro-enteritis due to arsenic, the minimum fatal dose of which is two grains.

As arsenic is a normal constituent of all human tissues, its source is obviously the food we take. The nature of the diet, that is, having a preponderance of animal or vegetable food substances, appears to determine the arsenic content of tissues and excreta of the individual. The diversity in basic diets and in habits of people of this country should, therefore, be taken into consideration in discussing toxicological and allied problems. This is also the reason why the figures for poisonous elements present in the human system, as worked out by the European workers on European subjects, are not quite suited for application to Indians in India.

## APPENDIX

### Arsenic content of common foods

(The figures indicate milligrammes of As as  $\text{As}_2\text{O}_3$  per kilo. or litre as the case may be, or parts per million.)

#### A. Animal food

Meat (goat) .. .. .	0.16
Beef .. .. .	0.43
Mutton .. .. .	0.33
Goat's liver .. .. .	0.56
Beef liver .. .. .	0.90
Mutton liver .. .. .	0.35
Chicken .. .. .	0.14
Egg (duck's) .. .. .	0.035
(hen's) .. .. .	0.028, 0.016
Koi fish ( <i>Anabus testudineus</i> ) .. .. .	0.036
Magur fish ( <i>Clarias batrachus</i> ) .. .. .	0.15
Rui fish ( <i>Labio rohita</i> ) .. .. .	0.36, 0.66
Lobster (with shell) .. .. .	1.98, 3.0
(edible portion) .. .. .	1.42, 1.70
Hilsa fish (edible portion) ( <i>Hilsha ilisha</i> ) .. .. .	3.0
(with scales and bones) .. .. .	4.0
Vetki ( <i>Lates calcarifer</i> ) .. .. .	0.18
Sea-fish (edible portion)—	
Pomfret ( <i>Pompas argenteus</i> ) .. .. .	3.13
Sole ( <i>Cynoglossus lingua</i> ) .. .. .	2.6
Tie (plaice) .. .. .	3.2
Halua .. .. .	3.58

#### B. Vegetables

Potato .. .. .	Nil
Brinjal or baigun ( <i>Solanum melongana</i> ) .. .. .	Trace
Sweet potato ( <i>Ipomœa batatas</i> ) .. .. .	Nil
Radish .. .. .	0.008
Karola ( <i>Memordica charantia</i> ) .. .. .	0.012
Shim or bean ( <i>Dolichos lablab</i> ) .. .. .	0.008
Lao or louki ( <i>Lagenaria vulgaris</i> ) .. .. .	0.007
Patol or parbal ( <i>Trichosanthes dioica</i> ) .. .. .	Nil
Green plantain ( <i>Musa sapientum</i> ) .. .. .	Nil
Jhinga ( <i>Luffa acutangula</i> ) .. .. .	Nil
Lal kumra or pumpkin ( <i>Cucurbita maxima</i> ) .. .. .	Nil
Cauliflower .. .. .	0.036
Cabbage .. .. .	0.13
Dumur or green fig ( <i>Ficus glomerata</i> ) .. .. .	Nil
Spinach or palong sak ( <i>Spinacia oleracea</i> ) .. .. .	0.030
Green papaya ( <i>Carica papaya</i> ) .. .. .	Nil
Green peas or karai sunti ( <i>Pisum sativum</i> ) .. .. .	0.008
Bhindi or lady's finger ( <i>Hibiscus esculentus</i> ) .. .. .	Nil
Carrot .. .. .	Nil
Beet .. .. .	Nil
Pui sak ( <i>Bassela rubra</i> ) .. .. .	0.04
Garlic .. .. .	0.13
Onion .. .. .	Nil, 0.016

## C. Cereals

Rice (polished)	..	..	0.20
" (unpolished)	..	..	0.24
Moong dal ( <i>Phaseolus mungo</i> )	..	..	0.11, 0.20
Masoor dal ( <i>Lens esculentum</i> )	..	..	0.20, 0.21
Arhar dal ( <i>Casarius indicus</i> )	..	..	0.10
Kalai dal ( <i>Phaseolus radiatus</i> )	..	..	0.10
Wheat flour (atta)	..	..	0.06
Gram or chhola ( <i>Cicer arietinum</i> )	..	..	0.12
Soya bean ( <i>Glycine hispida</i> )	..	..	Nil

## D. Fresh fruits

Orange (Darjeeling)	..	..	Nil
" (Nagpur)	..	..	Nil
Mango (green)	..	..	0.008
Guava ( <i>Psidium guajava</i> )	..	..	Nil
Banana or ripe plantain (Martaban variety)	..	..	0.04
Cucumber with skin ( <i>Cucumis sativus</i> )	..	..	0.004
Tomato	..	..	Nil
Grapes	..	..	0.006
Apple with skin (imported)	..	..	0.01
Sankh aloo (a tuber) ( <i>Pachyrhizus angulatus</i> )	..	..	Nil
Tamarind (green)	..	..	Nil

## E. Dried fruits

Raisins	..	..	0.13
Walnut	..	..	0.54
Pistachio	..	..	0.24
Almond	..	..	0.18
Ground nut ( <i>Arachis hypogea</i> )	..	..	0.11
Coconut ( <i>Cocos nucifera</i> )	..	..	0.036

## F. Fatty foods

Milk (cow)	..	..	0.11
" (buffalo)	..	..	0.12
" (human)	..	..	0.048
Condensed milk (country made)	..	..	0.19
Ghee	..	..	0.09
Butter (salted)	..	..	0.03
Mustard oil	..	..	0.12
Hydrogenated fats (Vanaspati)	..	..	0.06

## G. Prepared foods

Biscuit (imported)	..	..	0.05
" (country made)	..	..	0.06
Bread	..	..	0.06
Cake	..	..	0.12
Rasogolla	..	..	0.08
Kachuri	..	..	0.062
Sandesh with silver foil	..	..	0.08

## H. Miscellaneous

Common salt (imported)	..	..	0.02
" " (country made)	..	..	0.06
Ginger	..	..	Nil
Red pepper	..	..	0.02
Turmeric	..	..	Nil
Tea	..	..	0.18, 0.21
Rum (Indian)	..	..	0.013
Beer (Japanese)	..	..	0.025
Water (Calcutta supply)	..	..	0.004
Tank water	..	..	0.008
Sea water (from Puri)	..	..	0.38
Aerated water (lemonade)	..	..	0.008
Baby food (imported)	..	..	0.02
Glucose powder (imported)	..	..	0.008
" syrup (imported)	..	..	0.07
Corn syrup (imported)	..	..	0.05
Sugar (Indian)	..	..	0.05

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## DETECTION OF ARSENIC IN BURNT HUMAN BONES AND ASHES

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MAGISTRATES and judges often ask the question: 'Is it possible to detect arsenic in burnt bones and ashes?' In India, the practice of swift cremation is more prevalent than in any other country in the world, and this leaves a serious loophole for criminals. To avoid detection in cases of poisoning, criminals often resort to the practice of rapid cremation of the bodies of the poisoned persons. It is usually not possible to detect alkaloids and other organic or volatile poisons in burnt bones and ashes; and it is often contended on behalf of the accused that it is impossible to detect arsenic in burnt bones and ashes, as arsenic is a volatile poison and would be dissipated by fire and lost, beyond the possibility of detection, in anything reduced to ashes. That this contention is not quite correct is obvious from a careful study of the annual report of some chemical examiners (*Annual Report of the Chemical Examiner, Madras*, for the year 1902; *Annual Report of the Chemical Examiner, Punjab*, for the year 1931, page 11). Between 1924 and 1931, 92 samples of ashes and bones were examined in the Punjab and arsenic was detected in 10 of them. Between 1921 and 1940, 97 samples of ashes and bones were received for examination in the laboratory of the chemical examiner, United Provinces, Central Provinces and Agra, and arsenic was detected in 19 of them. The detection of arsenic, which would appear contrary to expectation to a lay mind, is really to be expected in genuine arsenical poisoning from a scientific point of view, for the following reasons:—

(1) Much of the arsenic in bones gets converted into arsenates, partially replacing the phosphates of the bones. Arsenates being non-volatile, arsenic can be detected in the bones even after strong heating for a long time.

(2) Even if all the arsenic were to be present in the bones in the form of arsenic trioxide or some other volatile form, all arsenic is not likely

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to be lost, as the conditions under which cremation is usually carried out in India do not favour complete combustion, and condensation of the volatilized arsenic on the cooler parts of the funeral pyre is liable to take place and its loss thus be prevented.

When arsenic trioxide (white arsenic) is heated with salts of sodium or alkaline earth group, part of the arsenic gets converted into arsenate and becomes non-volatile. Arsenic (2 mg.) was strongly heated in a furnace with (i) calcium phosphate, (ii) calcium carbonate, (iii) sodium phosphate, (iv) sodium carbonate and (v) sand. After the heating, arsenic was still detectable by Reinsch's test in all the cases except in the sand mixture.

The amounts of arsenic present in bones, before and after strong burning, were studied in a systematic manner in 13 cases of arsenical poisoning. The results obtained are outlined below :—

death in these cases was probably due to chronic arsenical poisoning. Arsenic is detectable in bones, especially in the spongy tissues of the skull and vertebral bones, long after the disappearance of all traces of arsenic from liver, spleen, kidneys or brain, and the proportion of arsenic in the bones to arsenic in viscera should be greater in cases of chronic poisoning than in cases of acute poisoning. This point is being investigated and an account of these investigations is reserved for a future communication.

Magistrates and police officers often ask the chemical examiner to determine quantitatively the amounts of arsenic present in burnt bones and ashes. Quantitative estimation of arsenic in burnt bones and ashes only is not likely to serve any useful purpose, as arsenic is present only in traces in the bones and as only a small proportion of the bones and ashes are sent to the chemical examiner. Moreover arsenic can

Case number	Amount of arsenic in the whole of the viscera received	Amount of arsenic per 100.0 gm. of viscera	AMOUNT OF ARSENIC PER 100.0 GM. OF BONES RECEIVED	
			Before burning	After burning
1 (from Aligarh) .. ..	1,515.0 mg. (23.3 grains).	400.9 mg. (6.17 grains).	0.88 mg.	0.75 mg.
2 (from Bahraich) .. ..	670.0 mg. (10.32 grains).	246.3 mg. (3.79 grains).	Skull—0.83 mg. Radius and ulna— 1.96 mg.	0.50 mg. 1.79 mg.
3 (from Bulandshahr) .. ..	2,570.0 mg. (39.58 grains).	241.3 mg. (3.72 grains).	1.00 mg.	0.88 mg.
4 (from Kheri) .. ..	1.58 mg. (0.024 grain).	0.6 mg. (0.009 grain).	0.95 mg.	0.75 mg.
5 (from Bijnor) .. ..	155.0 mg. (2.38 grains).	17.6 mg. (0.27 grain).	0.80 mg.	0.70 mg.
6 (from Bara Banki) .. ..	4,883.2 mg. (75.19 grains).	506.0 mg. (7.79 grains).	1.75 mg.	0.75 mg.
7 (from Bijnor) .. ..	1,562.5 mg. (24.05 grains).	463.6 mg. (7.13 grains).	0.35 mg.	0.25 mg.
8 (from Bulandshahr) .. ..	125.0 mg. (1.92 grains).	13.7 mg. (0.21 grain).	1.38 mg.	0.88 mg.
9 (from Unao) .. ..	0.064 mg. (0.00098 grain).	..	0.53 mg.	..
10 (from Bijnor) .. ..	220.0 mg. (3.39 grains).	21.6 mg. (0.33 grain).	0.13 mg.	0.12 mg.
11 (from Bulandshahr) .. ..	0.25 mg. (0.0038 grain).	..	0.15 mg.	0.13 mg.
12 (from Roorkee) .. ..	329.3 mg. (5.07 grains).	30.2 mg. (0.47 grain).	0.18 mg.	0.05 mg.
13 (from Bijnor) .. ..	574.0 mg. (8.84 grains).	44.0 mg. (0.68 grain).	0.15 mg.	0.08 mg.

Arsenic was estimated by the electrolytic Marsh-Berzelius method after the decomposition of the bones by the nitric acid method.

It is obvious from these results that arsenic can always be detected in cases of arsenical poisoning in burnt bones. Arsenic is in all probability present in the burnt bones in the form of arsenates.

In cases 4, 9 and 11, arsenic was detected in the bones although only minute quantities were found in the viscera, thus indicating that

enter the body in a great variety of ways in food, drink and medicines, and it has particularly to be remembered that arsenic may be detected in burnt bones of persons who die of a disease for which arsenic is, quite legitimately, being administered. How futile quantitative estimation of arsenic in burnt bones would be, will be evident from the following table, which gives the results of analysis of bones of 14 different persons (requisitioned for control blank experiments) who had died of accidents :—



Case number.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Nature of bone.	Skull	Cap of skull	Cap of skull	Cap of skull	Skull	Cap of skull	Cap of skull	Femur	Jaws and teeth	Humerus	Sternum	Cap of skull	Cap of skull	Cap of skull
Amount of arsenic in mg. per 100.0 gm.	11.89	0.42	0.56	2.88	1.06	1.19	1.31	1.25	9.76	2.05	71.88	0.98	1.06	1.14

It is also obvious from these results that when arsenic is detected in bones, criminal proceedings should be instituted only when other circumstantial evidence (e.g., other incriminating articles containing arsenic, symptoms of arsenical poisoning observed before death, etc.) are also found.

It is often asserted in the courts on behalf of the accused that arsenic is a normal constituent of the human body. This statement is not quite correct. We test the viscera of about 200 human bodies every year for the presence of arsenic, but arsenic is found only in a small proportion, and in the cases where arsenic is detected, symptoms of arsenical poisoning are generally present.

Arsenic is usually present in minute quantities in the soil in India. The following table gives the arsenic contents of some of the representative samples of earth obtained from the various districts of the United Provinces :—

Serial number	District from which the earth was received	Amount of arsenic in grains per pound of earth
1	Agra	0.055
2	Agra (from a different part of the district).	0.070
3	Allahabad	0.052
4	Bareilly	0.067
5	Benares	0.077
6	Bijnor	0.020
7	Bijnor (from a different part of the district).	0.070
8	Bulandshahr	0.098
9	Cawnpore	0.126
10	Cawnpore (from a different part of the district).	0.099
11	Etawah	0.140
12	Etawah (from a different part of the district).	0.120
13	Etah	0.070
14	Farrukhabad	0.087
15	Gorakhpur	0.042
16	Gorakhpur (from a different part of the district).	0.032
17	Kheri	0.025
18	Kheri (from a different part of the district).	0.056
19	Lucknow	0.098
20	Meerut	0.070
21	Meerut (from a different part of the district).	0.051
22	Moradabad	0.056
23	Muzaffarnagar	0.070

Serial number	District from which the earth was received	Amount of arsenic in grains per pound of earth
24	Muzaffarnagar (from a different part of the district).	0.044
25	Naini Tal	0.017
26	Pilibhit	0.061
27	Rae Bareli	0.067
28	Saharanpur	0.084
29	Saharanpur (from a different part of the district).	0.060
30	Shahjahanpur	0.070
31	Shahjahanpur (from a different part of the district).	0.018
32	Sitapur	0.075
33	Sultanpur	0.123
34	Unao	0.052

It should be obvious from these results that a blank test should invariably be done (and the necessary deductions made) in all those cases where ashes, vomits or purgings are received mixed with earth.

### COMBINED DIGITALIS AND RAUWOLFIA POISONING IN A HUMAN SUBJECT

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THE symptoms and signs of the toxic effects of digitalis are well known to the medical profession, on account of the cumulative action of the drug during its routine administration in cases of cardiac failure. Reference to poisoning with the drug by self-administration with a view to committing suicide has not been found in the literature; neither is there a record of such a large quantity as 1½ ounces of Digifortis (Parke, Davis & Co.) being swallowed by a human subject in a single dose.

Rauwolfia is an Indian drug which enjoys the reputation of being useful in lowering the range of blood pressure and also as a sedative to an excitable nervous system. An overdose, or a large dose administered over a prolonged period, has been known to lower the blood pressure much more than one would desire, producing

unpleasant symptoms. Some susceptible individuals have been known to suffer from intense throbbing of the head and severe uncomfortable feeling in the whole body, but no one has hitherto had an opportunity of studying the effect of as large a quantity as 3 ounces of liquid extract of rauwolfia swallowed in a single dose, in order to commit suicide. The interest becomes undoubtedly much greater when we find that such a large quantity of the drug was taken simultaneously with  $1\frac{1}{2}$  ounces of digifortis.

*Case report.*—The circumstances under which the poisoning occurred were very tragic. An otherwise healthy adult male of 40 years was undergoing treatment for essential hypertension with retinopathy. His blood pressure was recorded as systolic 205 and diastolic 165 mm. of Hg, and his urine showed a trace of albumin but no casts. Along with other remedies, liquid extract of rauwolfia was prescribed and the patient had been taking it for nearly two months. As a result of treatment, his blood pressure was lowered to systolic 165 and diastolic 125 mm. of Hg. At this time, a serious calamity befell the patient, as his wife who was apparently healthy suddenly died. The shock of this bereavement was too sudden and severe for him and he lost all control over his mind. He decided to commit suicide, and his eyes suddenly falling on the phials of medicine on which there were poison labels, he took the phials of digifortis and extract rauwolfia liquid (Union Drug Co.), poured their contents into his mouth, and finished them at once.

This occurred on 28th April, 1941, at about 8 a.m. He vomited once after taking the drugs, but the exact time which elapsed between the swallowing of the poisons and the attack of vomiting could not be definitely ascertained. The fact that the patient had taken the poisons was detected at about 10-30 a.m. and since then till about 12 noon, he was made to vomit several times. His stomach was also washed out several times with potassium permanganate solution. At noon, he passed a stool of normal colour and consistency and a fair quantity of urine.

Everything seemed all right till 2 p.m. when the patient started to vomit every 20 minutes to half an hour. The desire to vomit was so great that every now and then he asked for a drink of water which he vomited immediately. The evacuations were fluid and frothy. He passed altogether 5 stools within the next 16 hours, commencing from 2 p.m. He was also extremely prostrated. Intramuscular injections of glucose were made to sustain him. No remarkable abnormality was detected in the pulse. Next day, at about midnight, however, when the patient was examined, his pulse rate was found to be very slow and was 46 per minute. No abnormality in the rhythm could be detected at this time. After a bout of vomiting, the pulse rate increased to 80 per minute, probably owing to exertion. As the condition of the patient was very weak, a subcutaneous injection of one pint of saline with glucose was given. On the 29th, at about 1 a.m. the pulse rate began to show alternate acceleration and slowing and there was also gross arrhythmia. An injection of  $1/60$  gr. of atropine sulphate was given, and within half an hour of the injection the irregularity of rate and rhythm disappeared and the pulse rate steadied at 70 per minute. Vomiting continued throughout the day and night of 29th April. He passed highly coloured urine twice, once at 8 a.m. and a second time at 6 p.m., the quantity being 4 oz. each time. He also passed 5 liquid yellow stools containing streaks of blood. He also complained of a burning sensation in the whole of his abdomen. Another subcutaneous saline with glucose was given. On the evening of the 29th, when the patient was examined, his pulse was found to be soft and his blood pressure was 140/90 mm. of Hg.

On the 30th April, vomiting and purging continued and the patient passed 3 ounces of urine in the morning.

He was very much prostrated, the surface of his body was cold and clammy but his rectal temperature was  $100^{\circ}\text{F}$ . At 4 o'clock in the afternoon, the pulse was regular and its rate was found to be 140 per minute but the blood pressure fell to 85/35 mm. of Hg. As the vomiting still continued and the patient became very restless, one injection of morphine gr.  $\frac{1}{4}$  and atropine sulphate gr.  $1/100$  was given at 8-30 p.m. This induced sleep for nearly 6 hours and also stopped the vomiting. The next morning the vomiting started again though at longer intervals. The patient however remained restful and passed a fair quantity of urine and 4 liquid stools containing streaks of blood. The general condition of the patient was much improved but the systolic blood pressure still remained 110 mm. of Hg. From this time onwards for the next 2 days, the patient was kept under barbiturates by mouth and morphine by injection when necessary, and he was made to drink plenty of water. The vomiting and diarrhoea disappeared completely on the 4th May, i.e., 6 days after he took the poisons. His blood pressure on the 8th May was 130/90 mm. of Hg. It remained near this level till the 10th June, when it rose to 140/100 mm. of Hg. It was not till the 30th of August that the blood pressure rose to 180/140 mm. of Hg. The only remarkable thing during this period was that he suffered badly from hallucinations and suicidal impulses. The patient is now normal in every way except that his blood pressure is maintaining a high level.

From a study of the above case, we may note some interesting features which may throw some light on the clinical use of digitalis and rauwolfia. The first thing is the rapidity of absorption from the stomach and intestine. After swallowing the drugs, the patient vomited once, and, although the exact time of vomiting could not be ascertained, it must have taken place within  $2\frac{1}{2}$  hours of taking the drugs. It may be presumed that the portion of the poisons which remained unabsorbed in the stomach must have been thrown out during vomiting and the remaining trace was washed out. In spite of this fact, when we find that the toxic symptoms were so severe, we may infer that a large quantity of the drugs must have been absorbed quickly from the stomach. The effects of digitalis which became manifest earlier than those of rauwolfia appeared within 6 hours of swallowing the drugs and the first symptoms were the irritability of the stomach and intestines. Vomiting was more troublesome than diarrhoea. It took nearly 6 days for these symptoms to abate. The effects of digitalis on the heart showed themselves much later, nearly 16 hours after, and the bradycardia, 46 beats per minute, was the earliest and the most remarkable feature. The irregularity in the rate and rhythm was of a varied character, and as far as one could judge by feeling the pulse and listening to the heart, there were auricular fibrillation, flutter and severe degree of heart block. All these abnormalities, however, rapidly disappeared under the influence of atropine. The urinary flow was very scanty during the earlier stage, when vomiting and purging had been going on, but subsequently it was fairly free.

The effect of rauwolfia was detected about 36 hours after the drugs had been taken, but

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## POST-SULPHAPYRIDINE ANURIA

## WITH A CASE REPORT

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HÆMATURIA with or without anuria has been reported after sulphapyridine therapy, but anuria without hæmaturia does not seem to have been reported. The following case report is therefore of interest :—

A Hindu male forty years of age was admitted into Lieut.-Colonel G. R. McRobert's wards in the General Hospital, Madras, on 26th September, 1940, with cough and fever of forty days' duration.

Patient had frank hæmoptysis just before and for some time after admission. On physical and radiological examination he showed evidence of definite consolidation of the right upper lobe. Sputum was repeatedly negative for tubercle bacilli. There was no sign of resolution at the end of a fortnight. Blood Wassermann reaction was negative but Kahn was positive.

The hospital tomograph had not been installed then. It was impossible to say that there was no deep-seated cavity in the lung which might be the source of hæmorrhage. The situation was rather puzzling till the patient began to bring out foul purulent sputum. His constitutional symptoms increased then.

Sulphapyridine therapy was started on 23rd October, 1940, and between then and the 5th November the patient had 58.5 g. of the drug. The white cell count was high throughout, the lowest figure being 9,400 per c.mm. on the 1st November, the count on the 5th November rising to 15,000 per c.mm.

On the 8th November, the patient had vomiting and considerable pain over the hypogastrium and had not passed urine from overnight. Usual technique for promoting micturition having failed, he was catheterized. Under an ounce of clear urine was drawn off. It was unfortunately not examined under the microscope. On the next day there was severe pain in the loins and down the back and complete anuria, and not a drop of urine in the bladder. He was given alkalis and got in the course of the day altogether two pints of 4½ per cent sodium sulphate solution and three lots of 10 per cent glucose in normal saline, given intravenously. Bladder was empty on catheterization at 2.45 a.m. on the 10th instant. On the forenoon of that day, the patient was sweating profusely, the tongue was nevertheless moist and the pulse volume and tension were fair. The blood urea was 110 mg. per cent, van den Bergh reaction was direct negative, indirect faint positive and there were no abnormal spectroscopic bands in the

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it was not certain if these effects were present much earlier. The blood pressure fell progressively till it reached an alarmingly low level of 85/35 mm. of Hg. about 56 hours after taking the poisons. It also appeared that the rauwolfia effect lasted much longer, extending over a period of not less than 42 days.

After the acute symptoms had passed off, the patient had a severe attack of mental trouble, so much so that he had to be constantly guarded, lest he should commit suicide. Whether this mental factor was a continuation of his primary psychological trauma or whether rauwolfia played any part in its production is a matter which is difficult to decide. Personally, I would attribute it to the former.

blood. Twenty c.cm. of 20 per cent NaCl at 12-30 p.m. and 20 c.cm. of 25 per cent glucose were given intravenously. At 8 p.m. on the 10th instant the patient passed fifty-four ounces of clear yellow urine and thrice in the course of the night. The first specimen of urine was examined and was 1020 in specific gravity, alkaline to litmus, free from albumin and sugar, and contained in the centrifugalized deposit a few red and pus cells. The patient's condition rapidly improved and the blood urea came down to 26 mg. per cent on the 15th instant. There were no radio-opaque shadows in the urinary tract.

On the night of the 16th instant, the patient developed severe dyspnoea and respiratory distress. These were found on the next morning, on physical and radiological examination, to be due to an extension of the pneumonic process to the lower regions of the right lung. White cell count which was 8,750 per c.mm. on the 11th instant went up to 12,000 per c.mm. on the 17th instant.

There was an obvious indication for sulphapyridine but there was the danger of provoking anuria. It was ultimately thought worth while to take the risk. Sodium sulphapyridine was given intramuscularly, 1 g. in 3 c.cm. four times in the day. Fluids were forced, by mouth and by rectum, and 25 c.cm. of 25 per cent glucose solution were given intravenously every six hours.

On the 18th instant it looked as if the risk was well taken. There was considerable symptomatic improvement. The white cell count came down too to 8,000 per c.mm. Sulphapyridine treatment was accordingly persevered with. The improvement was deceptive. The patient developed anuria without hæmaturia again on that night and died on the next morning with, but presumably not of, anuria, for the blood urea immediately before death was only 21 mg. per cent. Autopsy was not allowed. A radiograph taken immediately after death showed no calculi in the urinary tract.

## Discussion

Southworth and Cooke (1939) and Graham *et al.* (Tsao, 1939) were apparently the first to report three and seven cases, respectively, of hæmaturia after sulphapyridine therapy. Southworth and Cooke's patients were 40, 17 and 30 years old and developed hæmaturia after 25.5 g. in six days, 10.5 g. in three days and 52.5 g. in ten days, respectively. All recovered after discontinuance of the drug and administration of fluids in abundance. Graham's cases also recovered. Tsao *et al.* (1939) reported five cases of hæmaturia, one of which was fatal. Their patients were six to seventeen years old and developed the renal complications after 3.5 to 7.5 g. in twenty hours to six days. Their fatal case was that of an eight-year-old patient who died after 6.5 g. in forty-eight hours. The cause of death was given as broncho-pneumonia with uræmia due to anuria caused by bilateral ureteral obstruction.

Tsao *et al.* (1939) suggested cystoscopic treatment, believing that their patient would have survived if this procedure had been carried out. This was done successfully by Carrol *et al.* (1940). Their patient developed first, hæmaturia and anuria after less than 30 g. in under five days. They suggested that the symptoms of renal colic and/or hæmaturia should make one suspicious of crystalline concretions in the urinary tract and should not be mistaken for gastric upsets.

Sadusk, Jr. *et al.* (1940) have reported two cases of complete anuria during sulphapyridine therapy. There was gross hæmaturia in both, before and after anuria. The anuria was in both due to calculi of acetyl-sulphapyridine blocking the urinary tract at the uretero-vesical orifices. Treatment by cystoscopy and ureteral washing with warm saline, keeping the catheters *in situ* for twelve hours, and by subsequent forced fluids, was successful in both. One patient was thirty-five years old and anuria developed after 29 g. of sulphapyridine in five days; the other was thirty-nine years old and had 37 g. in seven days. One of the patients died of a neuro-surgical complication. The pathological changes in the upper urinary tract consisted essentially of great tubular and capsular dilatation, marked congestion and vacuolization within the glomerular tufts and acute hæmorrhagic pyelo-ureteritis extending into the adjacent renal medullary tissue.

Fletcher (1941) has just reported yet another fatal case of anuria following sulphapyridine. Severe pain in the lumbar region and hæmaturia came on on the second day of administration, following 10 g. of the drug. Decapsulation was done on the fourth day of anuria (blood urea was then 155 mg. per cent). Kidneys were enlarged, lobulated and oedematous. No calculi were felt. Capsules stripped easily. The pelvis was bluish in colour from blood-stained grumous urine. In spite of pyelostomy and post-operative continuous intravenous drip transfusion, death occurred on the next day without any urine having been passed. In view of the failure of pyelostomy Fletcher presumes that the blockage was in the renal tubules and that ureteral lavage would have been useless. He makes no mention however of any post-mortem examination nor of the pathologist's report on biopsy specimens of kidney taken for section at operation.

That of all sulphonamide drugs sulphapyridine is most liable to cause renal complications, is well known. Factors promoting hæmaturia and concretion formation are discussed by Sadusk, Jr. *et al.* (1940) : It is not the reaction of the urine, for solubility of acetyl-sulphapyridine would appear to remain the same between pH 3.3 and 7.4 and does not seem to be sufficiently increased at pH 7.9; not the urinary output, nor the degree of acetylation, for neither is quantitatively related to the incidence of renal complications. Fletcher's (1941) suggestion of the prophylactic value of large fluid intake has thus no scientific basis. It will reduce too, the concentration of the drug in the blood and therefore its efficacy.

What then must be the methods of prophylaxis of renal complications after sulphapyridine? Children are apparently relatively susceptible. The total dosage of the drug has apparently no quantitative relation to the incidence of hæmaturia and/or anuria. It has recently been suggested that after initiation of treatment with

sulphapyridine, sulphathiazole may be used for maintenance effect. But Garvin (1941) has recently made a comparative study of the renal complications of sulphapyridine and of sulphathiazole. Of 54 patients on sulphathiazole he found crystals of acetyl-sulphathiazole in the urine of 33 patients and hæmaturia in 14.8 per cent; of 56 patients on sulphapyridine he found crystals of acetyl-sulphapyridine in 16 patients, but the incidence of hæmaturia was 10.7 per cent. Acetylation of sulphathiazole is less than conjugation of sulphapyridine, but a higher blood concentration is required for effective action with sulphathiazole than with sulphapyridine.

It is obvious that the only effective prophylactic measure consistent with effective antibacterial action is examination of the urine from time to time, and a careful lookout for renal symptoms. Flippin *et al.* (1941) have been concerned with reducing the toxicity of sulphapyridine without impairing its therapeutic value. They have failed to find a relationship between therapeutic effectiveness and blood concentration, for there is no appreciable change in the former between 2 and 15 mg. per cent of the free sulphapyridine in blood. Therapeutic effectiveness is not enhanced by more than 5 mg. per cent of free sulphapyridine and the toxic reactions increase with more than 5 mg. per cent. This finding is contrary to the belief hitherto held of need for greater blood concentration of free sulphapyridine for effective action. If confirmed, Flippin's findings will undoubtedly minimize toxic reactions.

#### Summary and conclusion

1. A case is described of anuria without obvious hæmaturia, twice following sulphapyridine therapy. Treatment by alkalis and forced fluids was successful on the first occasion, and the patient died of extension of the original disease soon after anuria on the second occasion.

2. The literature is reviewed on the incidence of hæmaturia and concretion anuria during sulphapyridine therapy. In every case previously reported there was either hæmaturia or anuria following on obvious hæmaturia.

3. Therapy, curative as well as prophylactic, is discussed. Forced fluids and alkalis may be enough in mild and moderately severe cases. Ureteral lavage, and perhaps pyelostomy, may be required in resistant cases. By way of prophylaxis, at the present moment, one can only be on the look out for renal symptoms and signs.

This case was presented at the Staff Clinical Meeting of the General Hospital, Madras, on the 30th November, 1940. We were not then aware of the value of ureteral lavage. My thanks are due to my chief Lieut.-Colonel G. R. McRobert, I.M.S., Professor of Medicine, Medical College, Madras, for his permission and encouragement to report this case.

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## THE PREVAILING TYPES OF PNEUMOCOCCI IN PNEUMONIA AND PNEUMOCOCCAL INFECTIONS

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(Working under a grant from the Punjab Government)

A SURVEY of the prevalent types of pneumococci responsible for causing pneumonia, pneumococcal meningitis and empyema has been considered a useful line of investigation, because of the aid it may give in elucidating the epidemiology of pneumonias and in determining their specific therapy. Such a survey, however, is an extremely laborious and technical piece of work, involving as it does the investigation of all the members of a community, including the sick, the contacts, and non-contacts, and marking the carriers. How long potent pneumococci persist in carriers, and the liability to variation of types, are important problems that need an answer. This type of work is possible only in controlled communities.

A beginning was made in 1936-37 (Dick, 1939) in the form of an investigation of serological types of pneumococci in lobar pneumonia; they were classified as Types I, II and III of Avery by the macroscopic agglutination technique. The unclassified organisms were classed as group IV.

The present inquiry initiated by the Punjab Government in November 1938, was to elucidate the following three aspects of pneumonia:—

1. The incidence of serological types of pneumococci in cases of pneumonia and other pneumococcal infections.

2. The response to the therapeutic administration of Felton's concentrated specific anti-pneumococcal serum mixture against Types I and II in the corresponding infections, in combination with M.&B. 693.

3. The chemotherapeutic treatment of pneumonia with sulphapyridine (M.&B. 693, Dagenan) alone.

The detailed report of the laboratory part of the work is the subject of this communication. Report on problems 2 and 3 have been published

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The cases recorded are from the usual admissions to the Mayo Hospital, Lahore, mainly Indians, Punjabi Muslims, Hindus and Sikhs and a few Europeans and Anglo-Indians.

The Indian patients are mainly of the poor classes, admitted to the general wards of the hospital.

The work is based on 196 consecutive cases of pneumonia and pneumococcal infections, admitted to the Mayo Hospital from January 1939 to March 1940.

The pneumococci in the sputum and purulent discharges were typed according to Neufeld's method, confirmed in most cases by the macroscopic agglutination method, applied to pneumococci obtained from peritoneal washings of the dead white mice, which had been injected with the sputum or pus that contained pneumococci. The confirmatory typing of the causative pneumococcus obtained by the culture of lung puncture material and of blood could not be done on account of limitation of facilities.

### Collection of material

Sputum that came from the deep respiratory passages, following upon a natural vigorous bout of coughing, was received in a clean sputum cup or petri dish.

In children and delirious adults, throat swabs were taken, inoculated in glucose broth, and incubated at 37°C. for 8 to 24 hours. The resulting culture was utilized for direct typing and for mouse inoculation.

The purulent discharges of pneumococcal infections of serous membranes were obtained through a sterile puncture needle.

A smear was stained by Gram's method. In the vast majority of pneumonias (lobar or broncho) the sputa were found to contain pneumococci in very great preponderance, and where these were scanty, examination for acid-fast bacilli was done, to exclude tuberculous infections.

A small amount of sputum was kept apart for direct typing, and from the remainder a firm portion about 0.5 c.cm. in diameter was sucked up into a sterile syringe without a needle, and washed three times in sterile salt solution. Then it was emulsified in about 1 to 2 c.cm. of sterile normal saline by sucking the sputum and the saline into the syringe, and spurring it out forcibly into a sterile petri dish. Repeating this process about a dozen times made a good emulsion, which was injected intraperitoneally into a white mouse. The animal was marked with a colour, and the coloured area recorded.

The exudates of the serous membranes showed pneumococci, generally in very large numbers.

Cultures from these were made in glucose broth and on blood agar. If the pneumococci were in small numbers, the fluid was centrifuged, supernatant clear fluid pipetted off and 1 to 2

c.cm. of fluid left at the bottom of the tube used for direct typing and mouse inoculation.

Precipitin methods of Krumwiede, Valentine and Oliver, have not been employed, because their results are not satisfactory in a fairly large proportion of cases, and as they entail an expenditure of large amounts of serum, they are uneconomical.

#### *Direct typing (Neufeld's Quellung phenomenon)*

**Technique.**—A small fleck of sputum or pus was placed with a platinum loop on a thin coverslip, mixed thoroughly with 2 loops of one of the polyvalent mixtures of known specific type sera (rabbit) and a loop of Loeffler's alkaline methylene blue. The coverslip was then inverted over a plane slide. The mixture spread out in a thin uniform layer, and was examined with an oil-immersion lens in artificial light made to pass through a blue filter. Such preparations were made with all the six polyvalent mixtures and examined for swelling of the capsule or 'quellung'. The swelling usually occurred in 2 to 5 minutes and occasionally in 15 to 30 minutes, therefore all negative preparations were re-examined after 1 hour. Having found out the positive quellung with a mixture, the test was repeated with the individual specific type antisera (rabbit) comprising the mixture.

These polyvalent mixtures are prepared so as to accord approximately with the relative incidence of various types, thus mixture A contains I, II and VII which are responsible for a very large percentage of cases. The mixtures used in this inquiry were the manufacture of Messrs. Parke Davis and Company and were made up as below :

Mixture A	..	Types I, II and VII.
Mixture B	..	Types III, IV, V, VI and VII.
Mixture C	..	Types IX, XII, XIV, XV and XVII.
Mixture D	..	Types X, XI, XIII, XX, XXII and XXIV.
Mixture E	..	Types XVI, XVIII, XIX, XXI and XXVIII.
Mixture F	..	Types XXIII, XXV, XXVII, XXIX, XXXI and XXXII.

#### *Special notes about direct typing*

(1) Sputum not older than two hours should be used. Sputum placed in a refrigerator preserves the reacting power longer. During the course of this work, it was noticed that sputum expectorated 4 to 6 hours earlier showed the typical quellung phenomenon. In 3 specimens of pus, the reacting property was preserved even for 24 hours after it was removed from the body. The same observation is recorded by Beckler and MacLeod (1934). In older sputa pneumococci probably autolyse.

(2) Sputum or pus for typing should be taken before treatment with M.&B. 693 is given, because the drug is said to have a specific lytic

action on the capsule which may, therefore, not react properly with the antiserum. However, in one case of pneumococci in sputum, and in 4 cases of pneumococcal pus, quellung reaction occurred when 6 to 10 grammes of M.&B. 693 (Dagenan) had been already given. This is a chance observation, and no systematic work has been done on it.

(3) Hanging drop preparations take longer to prepare, and are difficult to focus, possibly because of the varying depth of the drop. The method described is carried out most readily, and gives a uniform clear view of the field (Beckler and MacLeod).

(4) It is useless to look for quellung in daylight. The contrast provided by the filtered blue light and the medium stained blue with Loeffler's methylene blue permits the glossy halo of the swollen capsule to be detected readily.

(5) The platinum loop must be flamed thoroughly, and cooled before it is dipped in the specific antiserum, so that the serum does not get contaminated. A contaminated serum loses its specific antibodies very soon.

To preserve the potency of the diagnostic sera it is essential that these be stored in a cool place, as they are liable to deteriorate if stored at room temperature.

The diagnostic sera supplied contained methylene blue as well. But in our observation, this is not sufficient and an extra loop of Loeffler's methylene blue is almost a necessity.

In these moist preparations, made with (rabbit) antiserum, quellung reaction could be noticed after 24 or even 48 hours.

Positive Neufeld reaction has been obtained with fresh cultures of pneumococci in glucose broth, and blood-agar. It is, of course, remarkably clear in serous purulent exudates of man, and the experimental animal.

#### *Indirect typing with the macroscopic agglutination method*

A mouse inoculated intraperitoneally usually died in 12 to 24 hours. If at the end of 24 hours it was listless, it was killed with coal gas.

The mouse was pinned on a wooden board with the abdomen facing upward. The skin was sterilized by rubbing with methylated spirit, and the hair was seared lightly. The skin was reflected and pinned down to the board. A longitudinal opening in the middle of the abdominal wall was made. Using a bulb pipette, the peritoneum was thoroughly washed with 3 to 4 c.cm. of normal saline, and the washings collected in a centrifuge tube. A smear is made, and stained by Gram's method and the presence of pneumococci in pure culture is determined. When the peritoneal washings show a mixed type of infection, the heart is exposed by opening the chest, it is seared with a red cautery, and a thin sterile capillary pipette is plunged into one of the heart chambers, the blood so sucked up is inoculated into glucose broth, and blood-agar. The culture thus obtained is



suspended in saline, and utilized for macroscopic agglutination tests.

The peritoneal washings are centrifugalized at low speed for a few minutes, the supernatant suspension of organisms poured into a second centrifuge tube and the sediment, which contains cellular debris, discarded. It is centrifugalized at high speed for 20 to 30 minutes or until it is perfectly clear. The sediment is re-suspended in normal saline solution for the agglutination test.

The titres of the type specific antisera (horse) are given on the bottles, corresponding dilutions are made and a mixture of equal volumes of emulsion and diluted serum made. This is repeated with all the specific antisera. The whole set is kept in a water-bath at 37°C. for 2 hours and the result read. The reading may be further confirmed after keeping it overnight in the incubator at 37°C.

Positive agglutination is seen in the form of numerous granules that settle at the sides and bottom of the small conical tubes leaving clear fluid above. The clearness of the fluid vehicle and the clumping of bacteria is the hall-mark of positive agglutination.

*Special notes with regard to macroscopic agglutination*

(1) If none of the specific type sera show agglutination the identity of the pneumococcus

(4) Rubber-capped serum bottles could be kept uncontaminated for a long time, as the serum was taken with a sterile syringe and needle.

(5) Do not forget to keep a control tube of the emulsion of pneumococci and saline, in each set.

(6) Dreyer's agglutination tubes or similar tubes improvised from quill tubing demonstrate the agglutination test.

Pneumococci obtained by culture have to be confirmed by the following tests:—

1. Bile-solubility test:—Add 1 c.cm. of clear sterile ox bile or 10 per cent sodium taurocholate to 3 c.cm. of serum broth culture. Prepare a control by adding 1 c.cm. of sterile saline to 3 c.cm. of culture. The pneumococcal emulsion becomes clear in about 10 minutes, the reaction may be watched for 1 to 2 hours. Pneumococci are soluble but streptococci are not. The tube containing pneumococci becomes transparent.

2. Fermentation of inulin.

Inoculate a tube of inulin-serum-water medium, which is usually fermented and coagulated by pneumococci, but not by streptococci.

*Data and conclusions*

Table I shows that 120 (65 per cent) of 186 cases tried could be typed immediately by the

TABLE I  
*The total cases typed and number of cases typed by each method*

Number typed	DIRECT TYPING NEUFELD'S METHOD		INDIRECT TYPING			REMARKS
	Positive	Negative	Types I, II and III	Group IV or 29 types of Cooper	Indeterminate	
41	39	2	Not done			Rabbit serum only available.
109	64	45	59	50	..	Horse serum for types I, II and III only available.
36	17	19	16	15	5	
10	..	..	..	10	..	
Total 196	120	66	75	75	5	

must be confirmed by tests such as the bile-solubility test and the fermentation test. As a matter of fact, a bile-solubility testing tube must be incorporated with every macroscopic agglutination set.

(2) The serum must never be contaminated, and always stored in a cool place.

(3) It is the most accurate test known for the typing of pneumococci. Hence, whenever direct Neufeld has been negative, the type has been found in the large majority of cases by agglutination test against pneumococci obtained from peritoneal washings of mice inoculated intraperitoneally with the discharge.

direct method. Various other workers have reported 70 to 80 per cent positive results by the same method.

*Note.*—1. In the above group cases have not been taken consecutively.

2. The column marked 'indeterminate', refers to cases in which pneumococci were present in the peritoneal washings of mice inoculated with the morbid discharges. These could not be typed by agglutination method against the specific type sera of 29 standard types of Avery and Cooper, the remaining three type sera (against types 10, 14 and 26) not being available. In view of the specificity of the agglutination reaction, one may say that these indeterminate strains might have been one of the missing types or new types altogether.

TABLE II

*The detail of positive types by Neufeld's method*

Types	1	2	3	5	6	7	8	10	12	15	20	21	Mixed 1 & 2
39	22	2	..	..	1	7	4	1	1	..	1	..	..
64	42	5	4	1	1	3	..	..	2	2	..	1	3
17	8	6	1	..	..	..	..	..	..	..	2	..	..

Discrepancy between the negative Neufeld's figures is explained under the heading 'Analysis of failures by direct typing' (*vide infra*).

*Analysis of failures by direct typing*

1. Out of 66 cases that failed, 9 could be typed directly from the pneumococci of the peritoneal washings of mice in which the same morbid discharges were injected intraperitoneally.

2. The termination of pneumonia is considered by many authorities to be the result of autolytic changes in the pneumococci, especially in their capsules. It was considered worth while to analyse the quellung response of the capsules of pneumococci according to the day of the disease. This fact would have been

TABLE III

*Confirmation of direct typing by standard macroscopic agglutination method*

Number	Direct method types I, II and III	CONFIRMATORY INDIRECT METHOD		Direct typing IV to XXXII	CONFIRMATORY INDIRECT METHOD		REMARKS
		Confirmed	Unconfirmed		Confirmed	Unconfirmed	
64	54	51	3	10	Confirmation not done		
17	15	15	..	2*	..	2	Specific type sera against types X, XIV and XXVI not available.

\* These strains belonged to type 20 (by direct typing).

Thus 66 (93 per cent) of 71 strains were confirmed. It is however interesting to observe that these 5 strains could not be classified by agglutination. MacLeod and Beckler give 96 per cent of their direct typing confirmed by agglutination.

best illustrated by noting the reaction of the pneumococci of each case every day, till his discharge from the hospital. But this could not be done during the course of this work, because serum, or Dagenan treatment, was given soon after the case was admitted.

TABLE IV

*The detailed comparison of direct and indirect typing*

Types	1	2	3	4	5	6	7	8	10	11	12	13	15	20	21	25	Mixed 1 & 2	Mixed 7 & 9	Mixed 11 & 13	Group IV	Neufeld's negative	Indeter- minate
Macroscopic agglutination method.	52	12	7	..	..	..	2	1	..	2	1	2	1	..	..	1	5	1	2	50	..	5
Neufeld's method	50	11	5	..	1	1	3	..	..	..	2	..	2	2	1	..	3	..	..	..	64	..

TABLE V

*The type analysis of 120 cases which were Neufeld-positive*

Types	1	2	3	5	6	7	8	10	12	15	20	21	Mixed 1 & 2
	72	13	5	1	2	10	4	1	3	2	3	1	3

It will be seen from Table V that out of 120 direct positive cases 95 belonged to types 1, 2 and 7, while the other 255 belonged to all other types. It may be that the specific sera (rabbit) against types 1, 2 and 7 were more strongly antigenic than others.

Though the number of cases in Table VI is small the conclusion is striking. The remarkably high ratio of positive to negative Neufeld's on the first two days of disease amply bears out the hypothesis that the quellung reaction is best obtained early in the disease.

Table VII explains to a certain extent the discrepancy noted earlier.

It is seen that the highest incidence of pneumococcal infections is in the third decade and the lowest after the age of 50 years. This is practically the same as in many other acute infections, possibly because of increased stress and strain in the third decade of life.

TABLE VI

Day of the disease	1	2	3	4	5	6	7	8	After 8 days
Typing result	$\frac{+}{10} \frac{-}{2}$	$\frac{+}{16} \frac{-}{2}$	$\frac{+}{17} \frac{-}{11}$	$\frac{+}{18} \frac{-}{7}$	$\frac{+}{9} \frac{-}{6}$	$\frac{+}{15} \frac{-}{6}$	$\frac{+}{5} \frac{-}{10}$	$\frac{+}{6} \frac{-}{8}$	$\frac{+}{6} \frac{-}{11}$
Ratio of positive to negative.	5:1	8:1	1.5:1	2.6:1	1.5:1	2.5:1	1:2	1:1.3	1:1.9

TABLE VII

*The relation of day of the disease with negative quellung reaction, classified as in table I, column 3*

Day of the disease	1	2	3	4	5	6	7	8	After 8 days	Duration unknown
2 cases	..	1	..	..	1	..	..	..	..	..
45 cases	..	1	1	8	4	4	6	4	10	3
19 cases	..	..	1	3	3	2	4	4	1	..

TABLE VIII\*

*Distribution of pneumococci types according to age of the cases studied*

Types	1	2	3	6	7	8	10	11	12	13	15	20	Mixed 1 and 2	Mixed 7 and 9	Group IV and indeterminate	Total
0-10 years ..	3	..	..	..	..	..	..	..	..	..	1	..	1	..	4	9
11-20 " ..	23	..	1	1	3	2	1	..	..	..	..	..	2	..	18	51
21-30 " ..	27	7	2	1	5	3	..	1	2	2	..	1	..	..	14	65
31-40 " ..	14	1	..	..	2	..	..	..	1	..	1	..	..	1	10	30
41-50 " ..	5	..	1	..	1	..	..	..	..	..	..	..	2	..	2	11
51-60 " ..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	4

TABLE IX \*

Types	1	2	3	4	5	6	7	8	11	12	15	20	Mixed 1 and 2	Group IV and indeterminate	Total
Year 1939															
January ..	9	1	1	..	..	1	3	..	..	..	..	..	..	1	16
February ..	17	1	1	..	..	..	3	..	..	1	..	..	..	13	36
March ..	6	..	1	..	..	..	..	..	..	..	..	..	1	5	13
April ..	15	2	..	..	..	..	1	..	..	..	..	..	1	3	22
May ..	9	2	2	..	..	..	1	..	..	..	..	..	1	7	22
June ..	2	1	..	..	..	..	1	..	..	..	..	..	2	12	18
July ..	2	1	..	..	..	..	..	..	..	..	..	..	..	5	8
August ..	1	..	2	..	..	..	..	..	..	..	..	..	..	..	3
September ..	1	..	..	..	..	..	..	..	..	..	..	..	..	2	3
October ..	2	..	..	..	..	..	1	2	..	..	..	..	..	1	6
November ..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	2
December ..	3	2	..	1	..	1	1	1	1	1	1	1	..	..	13

Types	1	2	5	6	7	8	10	11	12	13	15	20	21	25	Mixed 7 and 9	Mixed 11 and 13	Group IV and indeterminate
Year 1940																	
January ..	2	1	1	1	1	2	1	1	1	2	1	1	1	..	1	2	..
February ..	1	3	..	..	..	..	..	..	..	..	1	1	..	1	..	..	3
March ..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3

\* Tables VIII, IX and X are taken from Taylor and Chitkara (1940).

*Epidemiology*

Type 1 is responsible for the largest number of cases. There is apparently diminished incidence of type 1 in the age groups 0 to 10 and 51 to 60. When these figures are taken in conjunction with the total number of cases in the age groups, and percentage incidence calculated, the real incidence will be found to be practically the same. The cases in other groups are very few, and correct deductions cannot be drawn. Incidence according to sex cannot be assessed from these figures, as Indian women do not come to the hospitals as frequently as men.

Pneumonia incidence in children is low because patients of this age group are generally

It is a popular belief amongst Indians that rainfall is followed by amelioration of respiratory disorders.

Apart from these factors which influence the activity of the pneumococcus, the constant relative preponderance of certain types over others suggests that the route of infection is by contact from case to case or from healthy carriers, as in many other infectious diseases. The present work has not been directed towards the elucidation of this problem. However, an interesting case illustrating the immense influence of contact infection is well worth mentioning. Two labourers were admitted into the wards the same day. They lived together in one small room and fell ill with pneumonia at an interval of one day. Their sputa contained

TABLE X

*The involvement of various lobes of the lung by the different types of pneumococci*

Types	1	2	3	6	7	8	10	11	12	13	15	20	Mixed 1 and 2	Mixed 7 and 9	Group IV or indeterminate
Monolobular ..	39	6	2	1	4	..	1	..	2	1	1	1	3	..	21
Polylobular ..	27	4	3	1	6	5	..	1	1	1	..	..	..	1	18
Left lower lobe ..	37	5	2	..	3	3	1	..	1	..	..	..	2	..	20
Left upper lobe ..	9	..	..	..	1	..	..	..	..	..	..	..	..	..	6
Right lower lobe ..	41	5	4	2	9	4	..	1	1	2	1	1	..	..	23
Right middle lobe ..	13	2	..	1	3	3	..	1	1	2	..	..	..	1	5
Right upper lobe ..	11	2	2	1	..	3	..	1	1	1	..	..	1	1	3

not brought to the hospital, so we cannot draw any definite conclusion from these figures. Similarly the number of cases in the age groups 41 to 60 are very small; any conclusion on a percentage basis would be fallacious.

Pneumonia cases occur throughout the year, being more numerous in winter than in summer. The number of cases begins to rise in November or December reaching the maximum generally in January or February, then recedes rapidly, rising again in May and June. This is in accord with the observations recorded by other workers.

Again type 1 is the commonest cause of infection in the larger part of the year. The incidence of the various types, however, varies considerably in the corresponding months of January, February and March 1939 and 1940. This is in accord with the opinion of Topley and Wilson that, 'Figures reported by various observers are sufficient to indicate that the incidence of the various types may vary widely from place to place and from time to time. Again the relative frequency of different types observed at one place at one time has not been maintained at other times and at other places'.

pneumococci type 1. Incidentally they responded equally well to the same serum, and Dagenan therapy.

The lobes most frequently involved are the lower lobes the incidence between the right and left sides being practically the same.

The progress of the disease, complications and mortality in this series of cases have been profoundly influenced by the serum and chemotherapeutic measures, and it is not fair to compare with those cases, which did not have specific treatment. This has been fully discussed in the clinical paper by Taylor and Chitkara (1940).

The phenomena of crisis and lysis in pneumonia have evaded satisfactory explanation. The administration of specific serum and the specifically-acting chemotherapeutic compounds is followed by crisis in a large number of cases, and is considered to be the result of their action on the pneumococcus capsule. Again, in Neufeld's quellung phenomenon, we have a method for finding out the intactness of the capsules. It would be interesting to repeat the Neufeld reaction from day to day right into convalescence, both in specifically-treated cases

(Concluded on next page)

## BLACKWATER FEVER IN DARJEELING-TERAI

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WITHIN a period of five years, 1935-39, twenty cases of blackwater fever have come under the writer's observation. The cases will be discussed from a clinical point of view with short notes on the treatment employed, as facilities for thorough laboratory investigations were not available in the locality.

### *Topography and climatology*

The cases of this series have been encountered in Siliguri, a subdivisional town of Darjeeling district, Bengal, a place 300 feet above sea level and situated about 7 miles from the foot of the Himalayas. The locality is hyper-endemic for malaria, the spleen index amongst children under 12 years of age varying between 60 and 70 per cent. The climate is hot and moist in summer and cold and dry in the winter. Rainfall is heavy between June and October and the annual rainfall averages 160

(Continued from previous page)

and controls in order to find out, on a statistical basis, the truth of the above commonly accepted hypothesis.

### *Acknowledgments*

Our thanks are due to the Department of Public Health, City of New York, U. S. A., for having kindly supplied the 29 standard diagnostic type specific (horse) antisera, free of charge.

Our thanks are also due to the members of the staff of the Pathology Department, K. E. Medical College, Lahore, for their technical assistance and suggestions.

### *Summary*

1. Direct Neufeld typing of pneumococci is successful in two-thirds of the cases. This method gives higher positive results when employed in the first 2 days of the disease.

2. The technique of the Neufeld and the macroscopic agglutination method is given.

3. Failures with Neufeld's technique have been discussed.

4. 93 per cent of positive Neufeld cases could be confirmed by the macroscopic agglutination method.

5. Types I, II and III are the commonest types met with at all periods of the year.

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inches. No regular anti-malaria measures are adopted by the municipality except occasional spraying of kerosene and crude oil mixtures in the principal breeding places of the town during the hot months, but the suburbs are always neglected. All the pernicious manifestations of malaria are encountered, especially during the monsoon months.

### *Incidence*

From table I it will be noted that the maximum number of cases occurs in the winter months, when there is a natural decline in malaria incidence. This is borne out by other practitioners of the town as well.

TABLE I

*Showing incidence of cases month by month*

Month	Number of cases	Month	Number of cases
January ..	2	July ..	1
February ..	2	August ..	1
March ..	..	September ..	2
April ..	..	October ..	5
May ..	..	November ..	3
June ..	..	December ..	4
		TOTAL ..	20

### *Age and sex*

The disease is more common in adolescence and males are more commonly attacked. Of the twenty cases treated, 15 were males and 5 females. The youngest patient was 4 years of age and the oldest one 56. Average age was 24 to 38 years. Of the twenty males of this series, one person has been included twice as he had two attacks in two consecutive years.

TABLE II

*Showing age incidence*

Age groups, years	Number of cases
1-10 ..	1
10-20 ..	6
20-30 ..	8
30-40 ..	4
40-50 ..	1
TOTAL ..	20

All the patients were middle-class Bengali Hindus in various employments, such as railway services, agriculture, household work, etc. Some of them are temporary residents of the place, while others have been domiciled here for more than one generation. Both these groups are equally susceptible. So far no case has been recorded amongst the *Rajbansi* community, the original inhabitants of the sub-Himalayan plains of Bengal.

*Predisposing conditions*

A lowered state of general health, over-exertion and exposure to chill were the exciting causes, but a history of frequent short attacks of fever was given in every case.

*Onset*

The onset of hæmoglobinuria is always sudden, and it usually appears within the first few days of the occurrence of fever; in several cases it has been found to occur with the first bout of fever.

TABLE III

*Showing the day of appearance of hæmoglobinuria*

Day of fever	Number of cases
1st day ..	3
2nd " ..	3
3rd " ..	7
4th " ..	5
5th " ..	2
TOTAL ..	20

*Relation with quinine*

Out of the twenty cases, intramuscular injection of quinine has been responsible for precipitating an attack of hæmoglobinuria in 3 cases; whereas 7 cases had taken quinine either as tablets or in mixture, during the first few days of fever before the onset of hæmoglobinuria. In one case, administration of one dose of 5 grains of quinine sulphate was responsible for precipitating an attack, but the urine cleared up quickly, soon after the quinine was withheld. The remaining 10 cases (50 per cent) had not taken quinine in any form during the particular attack of fever.

*History of previous attacks*

Of these 20 cases, 4 patients gave a history of a previous attack before they came under my observation; this number includes the second attack of the case that was counted twice in this series.

*Clinical manifestations*

The patient may have a previous attack of fever lasting for several days, and then a sudden superimposed abrupt rise of temperature, 104°F. to 105°F., accompanied by a shivering fit, pain in the loins and region of the spleen and liver and severe vomiting of bilious matter. There are however certain cases, though their number may be small, who had no history of previous fever; the patient has a sharp chill, followed by severe rigor, pain in the limbs and loins, and a high rise of temperature. He has a strong desire for micturition and then passes dark red urine. In a few cases, transient hæmoglobinuria has followed a high

rise of temperature without other signs and symptoms of blackwater fever. The urine clears up as the temperature returns to normal. Though a high rise of temperature is the rule, yet hæmoglobinuria has been observed in a patient whose temperature rose only to 100°F.

*Urine.*—There is always a tendency for diminution in the amount of urine, and in a severe case the quantity passed in 24 hours may be less than 15 ounces. In very bad cases, there may be total suppression. In typical cases, the urine is dark, coffee-coloured in the beginning and, passing through different shades, finally becomes tarry. In mild cases, the urine is passed freely, it is bright red in colour, gradually turning to brown, after which it clears up quickly. It always contains hæmoglobin in solution. Albumin is present in severe cases and epithelium, hyaline, granular and hæmoglobin tubular casts are found in the centrifugalized deposit. In our series of cases, the longest duration of hæmoglobinuria was 7 days and the shortest, a few hours. The average was 2.85 days.

*Gastro-intestinal tract*

Nausea, bilious vomiting, and jaundice are found in all the typical cases. Vomiting is always a distressing complication and seriously interferes with the administration of nutrition and medicaments by the mouth. In one of the patients, the tendency to vomiting persisted even after he was apparently cured and rectal feeding and intravenous glucose had to be resorted to for days together. Hiccough and epigastric pain are also common accompaniments.

Jaundice sets in early and lasts several days after the urine is clear. The liver is often tender, perhaps on account of the extra strain to cope with the hæmoglobin set free in the blood.

*Blood*

Blood was examined for malaria parasites in altogether 15 cases of which 6 showed presence of *P. falciparum* rings, 2 cases showing crescents as well. This gives a 40 per cent positive finding. In those cases, who had taken quinine before coming under observation, no parasite could be found in spite of repeated examinations.

TABLE IV

*Showing result of blood examination*

	Total cases treated	Total blood examined	M. P. found positive	Percentage
Cases having previous quinine.	10	5	0	..
Cases without having previous quinine.	10	10	6	60
TOTAL ..	20	15	6	40



Differential count always revealed increase in mononuclear leucocytes, sometimes exceeding 20 per cent.

*Toxæmia*.—If the urine is free, the consciousness is undisturbed, but, in cases with suppression of urine, severe toxæmic symptoms are noticed. In the only fatal case in the series, the patient had continued suppression for 3 days. She was delirious at first, but later died of coma, perhaps due to uræmia.

### Diagnosis

In practice, the only condition with which it can be confused in the early stage is bilious remittent malaria. In the latter condition, the onset is slow, an enormous quantity of bile is present in the urine, and jaundice is slow in appearance. A simple test is found in the textbooks: if a quantity of urine is shaken in a bottle, pink foam appears on the top in blackwater urine; it is yellow in bilious remittent malaria.

### Treatment

The main principle of treatment consists of:—

- (i) removal of specific cause; we must at present accept malaria parasites to be the cause,
- (ii) maintaining the flow of urine and combating toxæmia, and
- (iii) relieving distressing and urgent symptoms.

The patient should be put to bed and all quinine therapy, including quinine derivatives and combinations containing quinine, should be stopped at once. For controlling malarial infection, synthetic acridin derivatives, such as atebtrin (Bayer) or quinocrine (May and Baker), should be administered. In this series of 20 cases, I have used atebtrin with uniformly good result and no untoward effect, except that evidence of gastric irritation, has been noticed following atebtrin administration. As a routine measure it was exhibited in full doses in all cases whether showing malaria parasites or not.

In severe cases, atebtrin musonate, 0.2 to 0.3 gm., was injected intramuscularly during the first two consecutive days; this was supplemented by oral administration of atebtrin tablets of 0.1 gm., twice or thrice daily for one or two days following. In mild cases atebtrin was given by mouth. Atebtrin is mainly excreted through the kidneys; hence in a case with a tendency to diminution in the amount of urine, the dose should be carefully adjusted. By this, the temperature usually returns to normal on the third or fourth day, when the urine becomes clear.

To promote the flow of urine and combat toxæmia, plenty of fluid in the form of barley, glucose, soda and green coconut water, etc., should be enforced from the beginning. The bowels should be kept open by saline purgatives. Alkalis should be given in plenty to maintain

alkalinity of blood and urine, which should be tested each time it is passed.

If vomiting is persistent and the patient cannot retain sufficient fluid by the mouth, rectal saline with 5 per cent glucose should be enjoined. Injection of 25 to 50 c.cm. of 25 per cent glucose solution, intravenously several times a day according to the severity of the case, is very efficacious in maintaining the heart and circulation and inducing diuresis. Five to 10 c.cm. of a 10 per cent solution of calcium gluconate may be combined with the first injection of glucose solution in the morning during the active phase of hæmolysis. If suppression is imminent calcium may be replaced by 2 per cent sodium bicarbonate solution intravenously with glucose, and this may be repeated as often as necessary. Hypertonic saline and normal saline may also be injected according to indications. I have not tried large doses of sodium bicarbonate solution intravenously as recommended by Manson (Manson-Bahr, 1935). Amongst other measures, mention may be made of high rectal lavage, with warm water, dry cupping and hot fomentation over the loins. Liquid extract of *punarnava* and liquid extract of *Cassia beareana* in drachm doses may also help to maintain the flow of urine.

Of late, much importance has been attached to administration of infusion of leaves of *Vitex peduncularis* in the treatment of blackwater fever (Measham, 1940). The plant is popularly known as *ahoi* plant in the locality. In several cases of varying degrees of severity, we have used fresh decoction made from freshly collected leaves and found that, if it can be retained by the patient, it acts as a powerful diuretic, but unfortunately even in moderately severe cases its administration is complicated with extreme nausea and vomiting and the patients can hardly stand it; therefore, no therapeutic result is achieved in those cases. It appears to have no effect on temperature and malaria parasites, nor does it stop hæmolysis.

For maintaining heart and circulation, pituitrin, adrenalin, coramine, cardiazol, caffeine and sodium benzoate, and injections of glucose solution, normal saline, and where possible blood transfusion may be resorted to according to indication. Some recommend injection of liver extract as a routine measure, as a disturbance of the function of the liver is also supposed to play a part in the genesis of blackwater fever (Nocht and Mayer, 1937). This being a powerful stimulant to the hæmopoietic system also helps in the renewal of blood, which can be considerably promoted by iron and arsenic compounds, good nutrition, and adequate rest in bed.

### Result of treatment

One patient died out of 20, giving a mortality rate of 5 per cent. Manson-Bahr (1935) recorded average mortality rate of 25 per cent

(Concluded on opposite page)

# STAINS OTHER THAN BLOOD-STAINS AS MEDICO-LEGAL EVIDENCE

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and

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THESE stains, in order of their importance, are caused by (i) semen, (ii) faeces, (iii) urine, (iv) saliva, (v) sweat, and (vi) miscellaneous substances. They are found on the same kind of objects which are associated with blood-stains.

(Continued from previous page)

and Rogers and Megaw (1930) from 10 to 40 per cent. The writer fully recognizes that the percentage of mortality in such a small series has but little significance. Moreover, in an attack of blackwater fever, often there is one hæmoclastic crisis and the treatment is just to help the patient to tide over it; in most attacks, the hæmoglobinuria ceases after a few hours of its own accord and all conclusions, therefore, regarding the value of any particular form of treatment have to be drawn with the greatest reserve. The only advantage we have over the older method of treatment is that since the introduction of synthetic anti-malarial drugs the control of malarial infection in cases of blackwater fever has been easier.

## Summary

1. Twenty cases of blackwater fever have been treated in the plains of Darjeeling-Terai, with one death.

2. The features common to the cases are: fever, hæmoglobinuria, vomiting, jaundice and a tendency to diminution and suppression of urine.

3. The treatment employed mainly consists of administration of fluids, alkalis, non-irritating diuretics, intravenous glucose, plus atehrin parenterally and/or by mouth.

## Acknowledgments

I record here my sincere thanks to Mr. G. P. Plackett, general manager, and Dr. S. K. Biswas, head of the Medical Department, Darjeeling Himalayan Railway, for the facilities obtained during the treatment of these cases. I am especially grateful to Dr. Biswas for his encouragement in sending this note to the press.

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## Seminal stains

On one point an important difference of opinion may exist between medico-legal workers: should a positive chemical test, in the absence of finding spermatozoa under the microscope, be accepted as evidence of semen? Some are in favour of doing so (Bagchi, 1937), others against (Owens, 1935; Thomas, 1937; Kamath, 1938; Glaister, 1938; McNally, 1939; Modi, 1940; Rhodes, 1940) and yet others appear to leave the question open (Smith, 1940). The majority, by far, are against accepting the chemical evidence alone. This laboratory follows the majority. All stains suspected or alleged to be seminal are examined microscopically for spermatozoa. The serological test is not applied if spermatozoa are not found.

The chemical tests referred to are the Florence test (formation of brown rhombic crystals of probably periodide of choline on the addition of iodine and potassium iodide) and Barberio's test (formation of slender yellow-tinted rhomboid needles on the addition of a saturated aqueous or alcoholic solution of picric acid).

The serological test, incidentally, is applied for detecting human blood-protein (biological test for blood), not human semen-protein (biological test for semen). It is easier to prepare a fully representative anti-human-blood-protein serum from pooled sera, for detecting blood of subjects of all blood groups and blood types, than an equally representative anti-human-semen-protein serum.

On the appearance of the spermatozoa there is again a difference of opinion: Should the cells be seen entire (head joined to a neck which is joined to a tail) or parts, heads (Chakravarti and Roy, 1938) specially stained (Ganguly, 1936) will do? The majority are for accepting entire cells only. This laboratory follows the majority.

It is recognized that meteorological conditions in India are often against the detection of spermatozoa microscopically; the cells either become too brittle and difficult to detach, or decompose. This, however, cannot be made an excuse for reducing the standard of evidence.

The use of ultra-violet light only aids in locating the areas which bear suspicious staining; a positive result with it does not supply an evidence of semen.

It is now well known that the group-specific substances of the blood, isohæmagglutinogens, can also be present in semen (Wiener, 1939). From a seminal stain, therefore, the group of the subject can be determined. The writers have no experience of this determination. From their experience of saliva, however (*vide infra*), they do not consider such evidence dependable or reliable.

## Fæcal stains

Two years ago these stains started figuring in criminal procedure in India. Scriptures and places of worship were stated to have been

defiled with faeces, during communal disturbances. Determination of the source of the faeces was required. This led to an investigation in this laboratory concerning (i) the identification of faeces as such and (ii) reaction of an extract from known human faeces with anti-human serum. Specimens free from blood were obtained from the helminthological department of the School of Tropical Medicine, Calcutta. Twelve specimens were tried. Both the attempts failed. It was not possible to be sure of the nature or source of dried faeces. Later, another worker's opinion to the same effect became available. 'Obstetrical stains, those made by urine or faeces, are not amenable to chemical examination' (Rhodes, 1940). Serological test to determine the source of a stain is not applied if the nature of the material under investigation cannot be first determined.

#### *Salivary stains*

There is nothing characteristic of salivary stains microscopically. The fresh undiluted fluid is inactive with benzidine, but reacts with anti-human-blood-protein serum. 'Secretors' may have 'isohæmagglutinogens' in their saliva: all subjects are not secretors. These substances when present are supposed to occur in a high concentration: groups of subjects have been determined from saliva present on gummed edges of envelopes (Schiff, quoted by Wiener, *loc. cit.*) or on cigarette stumps. The writers' experience of determination of group from saliva is limited to reactions obtained with the naturally occurring isohæmagglutinins. These reactions are unsatisfactory. Immune anti-A and anti-B sera are open to the objection that many hæmagglutinogens occur in the red blood cells, and antibodies produced against them in the blood of the immunized animal may be responsible for many reactions still unknown (Greval and Chandra, 1941). Much more is known about the natural sera than about the immune sera.

It is stated that the isohæmagglutinogens are secreted in other fluids of the body by 'secretors' only, i.e., subjects who secrete them in their saliva. It follows, then, that the other secretions cannot be depended upon like blood.

The isohæmagglutinin in the semen is supposed to be secreted in the liquid, not contained in the cells (Wiener, *loc. cit.*). If that be so, then, the seminal fluid is as undependable as the saliva.

To a stain only presumed to be caused by saliva serological test to determine its source will not be applied.

#### *Urinary stains*

As stated above these stains are not amenable to chemical examination. Determination of group from them has the same fault as the one from saliva.

Experimentally, discrepancy has been reported in work on gorillas (Candela, Wiener and Goss, 1940). A monkey reported AB from

urine, was found to be a questionable B from blood.

Serological test is not applied if the nature of the material under investigation cannot be first determined.

#### *Sweat stains*

Certain drugs are excreted in sweat. Druging of horses can be established by chemical analysis of sweat.

In medico-legal work sweat interferes with the determination, by absorption, of blood group from stains. A blank control from the unstained portion of an article of clothing often absorbs one or both isohæmagglutinins totally or partially. 'Several authors have pointed out that in a surprisingly large number of cases this unstained material will contain one or more of the blood-group receptors, presumably from sweat, urine, animal matter, etc.' (Boyd and Boyd, 1937). Though an indication of the group can be obtained by comparison, the results are not definite and clear cut, and must for medico-legal purposes be rejected. Out of 247 controls tested in this laboratory the reaction of 143 was such that no opinion could be given on the exhibit corresponding to them.

Sweat (or presumably sweat or sweat plus animal matter from the surface of the body) on cloth, though it absorbs the isohæmagglutinins in a prolonged contact (overnight in a refrigerator), does not appear to react with the human-blood-protein anti-serum used in testing blood-stains; still, it indicates the need of controlling the precipitin test with an unstained portion of the cloth.

Identity of sweat cannot be established. Determination of blood groups from a stain only presumed to be caused by sweat is not possible as the serological test is not applied if the nature of the material under investigation is not first determined.

#### *Miscellaneous stains*

Dyes, paints, cosmetics, grease, juices from fruits and vegetables, and chemicals may produce stains looking like those of blood or semen. Attention has recently been drawn to a clay (bentonite) which simulates the benzidine reaction of blood (Greval and Roy Chowdhury, 1941). The clay is used in cosmetics. A brand of talcum powder has also been found to react with benzidine. Plant juices, such as potato juice and gum (often used in sticking labels on articles sent for examination), are known to react with benzidine.

Stains caused by these miscellaneous agents are of course found negative for blood spectroscopically and negative for semen microscopically.

#### *Summary*

1. *Seminal stains*.—Chemical evidence alone is not satisfactory: spermatozoa must be found. The spermatozoa must be seen entire, not heads

only. Ultra-violet light only locates suspicious areas: it is not evidence of semen. For determining a subject's blood group the semen is not as dependable as blood.

2. *Fæcal stains*.—Nature and source of these stains cannot be ascertained.

3. *Salivary stains*.—Nature and source of these stains cannot be ascertained. Fresh saliva reacts with anti-human serum. Some subjects secrete the blood group specific substances, detected by specially prepared sera, in their saliva. Tests with the normal group specific sera are unsatisfactory. Normal sera are preferable to specially prepared sera for immunological reasons.

4. *Urinary stains*.—Nature and source of these stains cannot be determined. Blood group specific substances occur in urine. Discrepancy has been reported in determination of group from urine and blood in monkeys.

5. *Sweat stains*.—Drugs are excreted in sweat. Sweat (or sweat plus animal matter from the surface of the body) in clothes interferes with determination of blood groups from stains. Identity of sweat cannot be established and blood group of the subject from it cannot be determined.

6. *Miscellaneous stains*.—Dyes, paints, cosmetics, grease, juices from fruits and vegetables and chemicals produce suspicious looking stains. A clay used in cosmetics gives a chemical reaction of blood. Fruit and vegetable juices give the same reaction.

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## A METHOD OF OILING STREAMS AND DRAINS BY AN AUTOMATIC DRIP SYSTEM

By ANANGA KUMAR MISRA

In charge Antimalaria Work, Kakajan Division

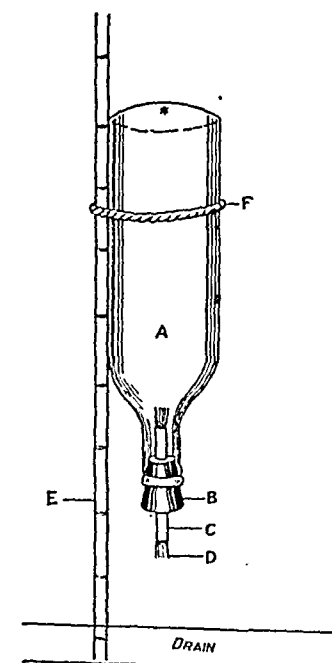
DURING the monsoon in Assam heavy rainfall turns the streams and drains into fast-flowing rivulets, when natural flushing deals with the larval colonies in an efficient manner. As, however, natural flushing is not a dependable and

constant factor, many drains and streams become abundantly 'positive' in the spells between heavy rainfalls. The oiling of the streams and drains periodically is, therefore, a necessity.

Of the many ways of oiling, spraying and the drip-can method are the most common. The former requires two men and the apparatus needs constant care and attention, the film of oil remains only a short time on the surface of the water and shade vegetation is often destroyed from an ill-directed spray.

The drip system has many and various types. This note introduces a simple and efficient method by automatic drip which has been tried out in this district and has proved both efficient and economical.

Two methods are in use of which the first is perhaps the better.



Type 1

- A. An ordinary bottle (beer or whisky) with cork.  
 B. A cork.  
 C. Glass tubing  $\frac{1}{4}$ -inch calibre through the cork,  $\frac{1}{2}$  inch outside the cork and  $\frac{1}{2}$  inch beyond the inner limit of the cork.  
 D. Stems of thatch grass 6 to 12 in number inside glass tubing.  
 E. Bamboo rod.  
 F. String tying bottle to bamboo rod.  
 \* If required make a very small hole here; this may be made by a steel driller. This is not necessary as bubbles of air find their way into the bottle via the spaces between the stems of thatch grass.

Type 1.—An empty whisky or beer bottle is filled with oil and the cork inserted in the mouth. Through the cork is passed a 2-inch length of glass tubing  $\frac{1}{4}$ -inch calibre so that

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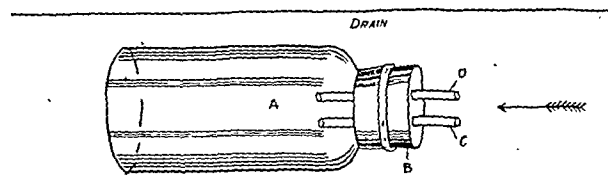
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about  $\frac{1}{2}$  inch of the glass tubing projects on either side of the cork. Through the glass tubing are inserted 6 to 12 stems of dried thatch grass about 6 inches long, leaving about 1 to 2 inches projecting outside the tubing. The bottle is tied to a bamboo rod about 4 feet long and this is then inserted into the bed of the stream with the bottle in an inverted position. The accompanying diagram illustrates the method. Provided the oil is strained, blockage rarely occurs and air finds its way through the spaces between the stems of thatch grass to the space over the oil.

One pint of oil is sufficient for 4 to 6 hours and will efficiently oil a stream of about 2 feet wide and 600 yards long.

*Type 2.*—This needs a fairly wide-mouth bottle, through the cork of which two glass tubes of  $\frac{1}{8}$ -inch calibre are inserted; the bottle is then filled with oil. The cork placed in position, the bottle is now put into the stream in a slant-wise position with the mouth facing the flow. The force of the current forces a little water into the bottle and an equivalent amount

of oil into the stream. The bottle should be anchored by a bamboo stake.



*Type 2*

- A. A wide-mouth bottle with cork.
  - B. A cork.
  - C. Glass tubing for entry of water.
  - D. Glass tubing for oil exit.
- The arrow indicates the direction of flow.

This method is as efficient as the first but perhaps needs a little more care.

The diagram illustrates the method.

I am greatly indebted to Dr. H. Giblin, the medical officer, without whose help this experiment would have been impossible, and also to Mr. C. Sheard, the divisional manager, Kakajan Division, for his kind advice and supply of necessary materials.

## A Mirror of Hospital Practice

### RUSSELL'S VIPER VENOM IN THREATENED MISCARRIAGE

By K. N. PRADHAN, L.M. & S. (Bom.), B.Sc. (Nag.)  
The Private Hospital, Amrut Building, Main Road, Sitabuldi

*History.*—13th February, 1941. Mrs. A., aged 25, has the following history. Last menstruation—September 1940.

Record of previous pregnancies:—

- 1st. Still-born.
- 2nd. Born at 8th month, lived 2 days.
- 3rd. Living now, 8 years (girl).
- 4th. Living now, 5 years (girl).
- 5th. Still-born.
- 6th. Still-born at 8th month.
- 7th. Bleeding for a week, nothing could stop it, and miscarriage at 5th month.

*Present pregnancy.*—8th. Bleeding commenced on 10th February and miscarriage appeared imminent.

*Treatment.*—14th February. Russell's viper venom intramuscular in the gluteal region. 1st dose 0.5 c.cm. of 1 in 3,000 solution. Bleeding checked within 3 hours. No pain—no general reaction.

16th February.—2nd dose 1.0 c.cm.

20th February.—3rd dose 1.0 c.cm. Bleeding completely stopped.

26th May.—Pregnancy 8 months L.O.A. Foetal heart heard, head floating.

7th July, 1941.—I received the following report from the lady doctor in charge of the case:—

'I have just finished the delivery of Mrs. A. Unfortunately it turned out to be a most difficult case, with hydramnios, extended lower and upper extremities with no proper labour pains. I had given her two injections of pituitrin 0.5 c.cm. with very slight effect. The foetal heart was quite good but the delay in the after-coming head (about half an hour) was probably the cause of death. It was a full-term male child.'

### Summary

Russell's viper venom is of definite value in uterine hæmorrhage.

### AN ENCEPHALOCELE\*

By M. N. PALADHI, L.M.F. (Bengal)  
Medical Officer, Lohaghat Dispensary, Almora, Himalayas

I WAS recently sent for by a midwife in charge of the local child-welfare centre, Lohaghat, on account of an abnormal child which had just been born.

It was a fully-developed female child with a fluctuating tumour the size of a green coco-nut in the occipital region. It was completely covered by skin and there was thick black hair over about half of the tumour. The top of the head was flat and only about half an inch above the supra-orbital margins. The child was alive and the heart was beating normally but the respirations were somewhat slower than usual. The child died about 12 hours after birth. Incision into the tumour showed it to contain meninges, cerebro-spinal fluid and brain. I was not allowed by the parents to make any further examination such as opening the skull.

The mother gave a history of occasional very severe abdominal pain during pregnancy and it was stated that the pregnancy was of twelve months' duration.

The midwife informed me that the tumour presented first after the membranes were ruptured and labour ended in about half an hour, the placenta following the child almost immediately.

I wish to thank Dr. C. K. Misra, Civil Surgeon, Almora, for permission to report the case.

# Indian Medical Gazette

DECEMBER

## THE EVOLUTION OF BLOOD TRANSFUSION AND THE PRESENT EMERGENCY

A CRITICISM frequently levelled at scientific medicine is that a treatment which is hailed as a great discovery one day is decried as being out of date the next. There is of course some truth in this criticism—but not much. We do, in fact, occasionally have our 'fads and fashions' which are acclaimed prematurely and on very inadequate grounds; these when put to the test of scientific proof are often found to be wanting, and are discarded. There are, however, few real advances, based on scientific investigation and well tested before they are given out to the world, that do not maintain their place in medical practice for many years, perhaps only to be discarded when some better drug, or method, comes along and replaces them; this, we claim, is progress.

Another charge, given very apt form by that great critic, Bernard Shaw, is that 'every great medical discovery is made once every fifty years'. This criticism again has the semblance of truth, but does not reflect the whole truth, for it often happens that some method of treatment, let us say, which had a sound theoretical basis, was found in practice to be useless, or even dangerous, until fifty years later when some other advance is made which makes this same method now a useful and perfectly safe procedure.

Thus, although scientific medicine does sometimes appear to move in circles, at each turn of the wheel something more adheres to it and real progress is made. Perhaps the best example of all was the introduction of antiseptic methods which allowed the successful revival of many discarded surgical procedures, but blood transfusion provides yet another equally good example of a scientifically conceived procedure that took many years to become established.

Blood transfusion was first practised in the seventeenth century, at the very beginning of the present era of scientific medicine, and was again revived early in the nineteenth century; it must have achieved some dramatic successes or it would not have had the following that it enjoyed for a few years, but the disasters were equally dramatic and it was almost entirely abandoned for many years; it was in fact forbidden by law in more than one country. Then came Landsteiner's great discovery of the isohæm-agglutinins and -agglutinogens, and Moss's and Jansky's determination of the blood

groups, and blood transfusion began to take its place in therapeutics.

The transfusion of compatible blood was found to be not only a perfectly safe procedure, but one that very frequently carries the patient over a critical period and saves his life. Its greatest uses are in severe hæmorrhage and in shock *sine* hæmorrhage; it is therefore a little surprising that blood transfusion did not come into greater prominence during the last war. However, blood transfusion services have been well established in most progressive countries for over twenty years, though it was the Spanish civil war with its very large numbers of civilian air-raid casualties that emphasized the very great value of blood transfusion in such conditions and gave a stimulus to blood transfusion organizations throughout the world.

Blood transfusion is usually an emergency measure and the inevitable delay in obtaining a suitable donor will frequently be serious; the possibilities of obviating this delay were therefore explored. It was found that, if blood is taken under strictly aseptic conditions and kept in a cool place, it will maintain all its therapeutic properties for at least ten days. Organizations were therefore set up for keeping a number of transfusion doses of blood of the various groups ready for immediate use. In large centres this worked very well in normal times, as the requirements could be estimated fairly accurately. But, at the beginning of this war, the blood transfusion services in England, anticipating a demand for blood, called up a number of volunteers and collected a large stock of blood against this possible demand; no air raids occurred in the early days of the war and much of this blood became time-expired and had to be discarded.

The idea of using serum or plasma in the place of whole blood was not a new one, and, as there seemed no means of prolonging the life of whole blood *in vitro* beyond the ten days, the possibilities of using the plasma removed from time-expired blood in the place of whole blood were further explored. Recent work has shown that, in many conditions, plasma is quite as useful as whole blood, and, as it can be preserved for a considerably longer time, for storage purposes plasma replaced blood.

Plasma however has its limitations; it has to be kept at a very low temperature or changes occur, and though it can be stored for a much longer time than whole blood, this time is limited, so that again wastage is likely to occur. It was next found that if the moisture is removed from the plasma, by some process that does not entail denaturation of the serum protein, it can be preserved at atmospheric temperatures for a very much longer time than fluid plasma could be preserved in the refrigerator; such dried plasma can be redissolved in sterile distilled water wherever it is required for use. This last advance has opened up great possibilities as it has facilitated very considerably



the transport of plasma, and will probably in actual practice remove the time-limit for storage almost entirely; it is now possible to collect plasma from anywhere in the world for use in any other part of the world. The practical result of this is that in neutral countries such as America, and in Canada, Australia and other parts of the British empire, numerous blood banks have been started for collecting blood from which the plasma is separated and dried, to be sent to the theatres of war and to towns in Great Britain for use for air-raid casualties. One thus has the humanitarian example of the American sympathizer in Kansas City giving his or her blood to save the life of an Indian soldier six months later at Keren, and of the Canadian residing in safety in London, Ontario, helping to build up the plasma reserves for his British cousins in the bombed areas in London on the Thames.

A scheme has recently been inaugurated under the auspices of the Government of India for drying plasma in India for use in the eastern theatres of war and amongst the civilian population in India in the event of air raids on our towns. An apparatus for drying plasma has been ordered from America and is expected in this country before the end of the year. The first machine is to be located in Calcutta. Before plasma can be dried, the blood from which it is to be separated must be obtained, and it is hoped that this blood will be obtainable on a voluntary basis.

The medical profession has a very important part to play in this scheme, by way of educating the public. Every medical man knows that a person in ordinary health can give a pint of blood without the slightest ill effects to himself; he knows that the physiological reserves of the body are quite capable of compensating this loss immediately without in any way affecting the body functions, that the stimulation to the healthy hæmopoietic system caused by this blood loss is certainly innocuous and quite possibly beneficial, and that the loss will be made good within a week; but the average layman does not know all this, he thinks that, just because when he cuts his finger, he loses a few drops of blood, and feels faint, he will be seriously ill if he loses a pint of blood; he does not know that the faintness when he cuts his finger is entirely psychological in origin. He has also many entirely unfounded prejudices on the subject, fostered by fables and old wives' tales, and sometimes by distorted religious teaching, which it is the duty of the medical man to dispel.

We know the extreme value of blood transfusions in an emergency, and it is our duty to impress on our patients and on all those with whom we come in contact socially, not only the fact that blood can be given without harm to the donor, but that it is often the only substance that will save a wounded soldier's life, and that to give a relatively small quantity of blood, which they will not miss, is a very small thing to do for those who are fighting for them.

## Special Articles

### HÆMATOLOGICAL TECHNIQUE

#### PART XIV

By L. EVERARD NAPIER, F.R.C.P. (Lond.)

and

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#### B. TRANSFUSION

##### *Transfusion of different elements of blood*

1. *Whole blood*.—Whole blood which acts as a 'complete tissue graft' is ideal for transfusion where all the elements of blood are required, but transfusion of whole blood demands a special apparatus, or considerable dexterity and a team of trained workers when the ordinary syringe is used; also the transfusion has to be given very rapidly which may not be advisable. The whole operation of withdrawing and transfusing the requisite amount of blood must be completed within 3 minutes, as otherwise the blood will clot in the syringe. It is seldom practicable to use a syringe larger than 50 c.cm. and of these three will be required; one to withdraw the blood and one to give it, the third one

being washed out with sterile citrate saline ready for use again.

2. *Citrated blood*.—As an anti-coagulant various strengths of sodium citrate from 2.5 per cent to 3.8 per cent, so that the final strength of the sodium citrate in the mixture is from 0.38 to 0.5 per cent, have been suggested. We prefer to use 3.8 per cent sodium citrate arriving at a final dilution of 0.38 per cent; with this strength the dilution of the blood is not great and it is easy to calculate the amount of sodium citrate solution required, viz, 10 c.cm. for each 100 c.cm. of the mixture.

Citrated blood can be used immediately, or, if collected with certain precautions, it may be preserved\* in a refrigerator at 2 to 3°C. and used later; ten days is usually considered the maximum safe storage time.

\*Following preservative is recommended for stored blood:—

Sodium chloride	..	0.43 gm.
Sodium citrate (dihydric)	..	1.05 "
Dextrin	..	8.5 "
Distilled water	..	100 c.cm.
50 c.cm. of solution with 100 c.cm. of blood.		

A great advantage in using citrated blood is that the time factor is unimportant. The flow can be regulated, and if necessary it can be given by the drip method. Transfusion of citrated blood is, however, often followed by a mild reaction.

3. *Plasma*.—If the citrated blood is allowed to stand undisturbed in the refrigerator, the corpuscles completely settle to the bottom of the bottle in two or three days' time and leave the clear plasma at the top. The plasma can now be pipetted off without disturbing the corpuscles at the bottom.

Thus separated, the plasma, after being filtered, can be used at once, stored in a refrigerator for future use, or dried by various processes and later redissolved and used. The great advantages of dried plasma are reduction in bulk and ease of storage, as it is not necessary to keep dried plasma in the cold. Dried plasma can be used for more than a year from the date of its collection. Transfusion of plasma is not usually attended with any reaction, it does not transmit malaria, and grouping of the blood is made unnecessary if the blood of several persons of different groups is mixed before or even after the plasma is separated. It is an ideal therapeutic agent to combat shock and is being very extensively used in the war, as its small bulk facilitates transport.

4. *Resuspended corpuscles*.—The concentrated corpuscles remaining at the bottom of the bottle after the plasma is separated off can be used for transfusion in suitable cases of anæmia. According to Kolmer (1940), these red cells can be used with satisfactory results up to about eight days, after which their oxygen-carrying capacity and other properties begin to diminish gradually. The concentrated red corpuscles are diluted with glucose-saline—to each 400 c.cm. of sedimented red cells, 50 c.cm. of 1.1 per cent saline with 4.5 grammes of glucose is added, so that the final strength of the glucose in the mixture is 1.0 per cent. The chances of a reaction following the transfusion of the concentrated red cells will be reduced if the leucocytes and platelets, which form a white layer on the top of the red cells, are discarded, and if the mixture is filtered before administration (MacQuaide and Mollison, 1940).

5. *Defibrinated blood*.—The use of defibrinated blood is now almost obsolete, for the process of defibrination removes many vital properties of the blood and also renders it more toxic.

6. *Placental blood*.—It has been suggested that the blood left in the placenta at delivery should be utilized for transfusion. Not only is it very difficult to ensure the sterility of this blood, but any procedure that encourages the deprivation of the infant, of even a drachm of the blood that is its due, is in our opinion an immoral one.

7. *Cadaver blood*.—This has been used in Russia and in certain special circumstances

the utilization of the blood of a body that has no further use for it seems justifiable. In a hot climate the difficulties would be so great that the method need not be discussed here.

8. *The use of heparin as an anti-coagulant*.

(a) *In vitro*, heparin may be used in place of sodium citrate solution; 4 mg. for each 100 c.cm. of blood is recommended.

(b) *In vivo*, 1 mg. per kilogram body-weight is given intravenously to the donor. After the injection, the coagulation time is greatly lengthened; although this relative incoagulability of the blood persists for 30 to 60 minutes or more, it is recommended that the blood be collected from the donor 7 minutes after the injection, that the transfusion be given through a wide-bore needle, and that it be completed within 15 minutes. Injection of such a blood is not injurious to the patient in any way and does not alter the coagulation time of his blood.

Transfusion by this method can be given with a 50 or a 100 c.cm. syringe, and no special apparatus is required.

#### Indications for transfusion

1. *After acute hæmorrhage*.—To make good loss sustained by an acute hæmorrhage, the transfusion of whole or citrated blood, either preserved or fresh, is the most effective. The amount to be transfused will be dependent on the amount lost, but anything less than 500 c.cm. is unlikely to be effective.

2. *In shock*.—When this follows hæmorrhage, it is probably most effectively treated by transfusion of whole or citrated blood, but shock without much, or any blood loss, following burns for example, which is due to hæmoconcentration and stagnation of the blood in the internal organs, is more effectively treated with plasma alone, fresh or reconstituted from dried plasma.

3. *As a prophylactic measure against shock*.—In weak or exsanguinated patients, even if their condition would not ordinarily demand transfusion, this is often a very valuable procedure to prepare them for a surgical or obstetric operation; blood or plasma is given according to the blood state of the patient.

4. *In anæmia*.—Blood transfusion is indicated to replace blood lost by hæmorrhage or destroyed by other processes, to maintain life in the case of aplastic anæmia, and/or to stimulate blood formation. Whole blood, citrated blood, or resuspended corpuscles can be used. In anæmia, repeated small transfusions of 300 to 400 c.cm. are usually better than a single big transfusion of, say, 1,000 c.cm.; in either case slow administration is to be recommended.

5. *For supplying other deficit elements*, viz, platelets in thrombocytopenic purpura, leucocytes in agranulocytosis, or fibrin in some cases of clotting deficiency, transfusion of whole blood will sometimes be effective.

6. For counteracting toxæmia or increasing passive immunity, which was at one time in favour, particularly in America; the bloods of convalescents or of others who had received injections in order to raise the antitoxic value of their blood, or to produce active immunity, were used as specific transfusions in certain cases. However, the new chemotherapeutic agents introduced in the last few years have put this procedure into the background.

### Technique of collection and transfusion of blood

#### Apparatus and solutions required

- (i) Sphygmomanometer.
- (ii) Stethoscope.
- (iii) Bottle for collection of blood (figure 1).\*
- (iv) Potain's aspirator, or a Higginson's syringe.
- (v) Glass container with an opening at the bottom to serve as a reservoir for the blood (figure 2).
- (vi) Drip apparatus (figure 3).

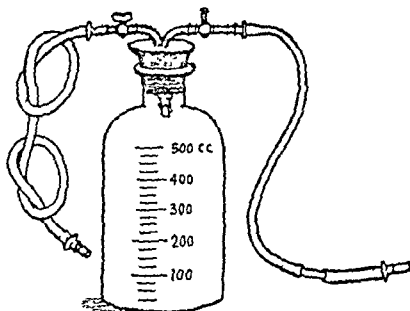


Fig. 1.—Potain's aspirating bottle, used for receiving blood.

- (vii) Two moderate-size serum-syringe needles in a beaker containing liquid paraffin. It is better to have two sizes as a smaller bore is required for giving than for drawing blood.
- (viii) Rubber pressure tubing.
- (ix) Surgical silk thread.
- (x) Pair of scissors.
- (xi) Two enamel bowls.
- (xii) Lifter.
- (xiii) Drum of sterilized dressings and towels.
- (xiv) Thermometer.
- (xv) Rubber cloth.
- (xvi) Measuring cylinder.

\* A Potain's aspirating bottle makes a very useful receptacle for taking blood from a donor. Pieces of pressure tubing are attached to the inlet and outlet taps; to the other end of the inlet tube a record adapter is inserted ready to receive the needle, and the other end of the outlet tube is attached to the Potain's syringe. As an extra precaution to prevent micro-organisms passing into the bottle during the back stroke of the Potain's aspirator, a piece of glass tubing containing a plug of sterile cotton-wool may be inserted in the length of the pressure tubing.

The bottle is graduated on its outer surface by marks at 25 c.cm. intervals up to 500 c.cm., so that the amount of blood collected can be seen at a glance.

The joints, taps, etc., must be absolutely air-tight.

There are many standardized bottles now in use in Britain and America which can be used for collecting, storing, and giving blood without transferring it; the chances of contamination are thus reduced to a minimum. The bottles are made so that for giving blood they can easily be hung in an inverted position, and an air inlet tube inserted. Such a bottle is described by Hamilton Bailey (1940) (figure 4). See also Hayes *et al.* in last issue of this journal.

- (xvii) Examination couch or easy chair for the donor.
- (xviii) 3.8 per cent sodium citrate solution and normal saline, both freshly prepared with pyrogen-free † distilled water, and sterilized.
- (xix) Tincture of iodine.
- (xx) Tincture of benzoin.
- (xxi) Absolute alcohol.
- (xxii) Bowl of antiseptic lotion.
- (xxiii) Glass of water or some beverage to counteract any temporary psychological shock experienced by the donor.

Additional apparatus if the transfusion is given by the open method

- (i) A splint to immobilize the limb in which the transfusion is given.
- (ii) Dissecting instruments, viz, scalpel, scissors, probe, forceps, and aneurism needle.
- (iii) Sterilized silk.
- (iv) Curved needle and silkworm gut.

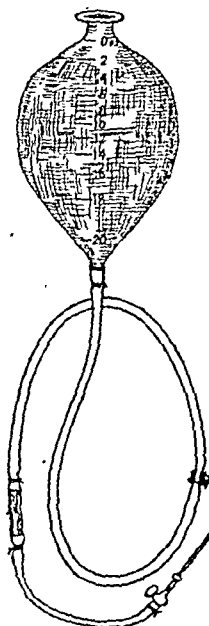


Fig. 2.—Transfusion apparatus for giving blood or saline, with the drip-feed apparatus incorporated in the tube (in this figure the length of the tubing between the drip-feed and the needle is shorter than it would be in practice).

#### Selection of donors

Strong healthy persons between the ages of 20 and 45 are the best donors, but healthy adults up to 60, at least, are quite satisfactory. The donor must be free from any infectious disease and his blood must always be examined for syphilis (Wassermann or Kahn reaction). He should be questioned about allergic manifestations, e.g., asthma, urticaria, etc., as a temporary sensitivity to allergens may be

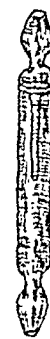


Fig. 3.—Drip-feed apparatus.

† Water may be made pyrogen-free in the following way:—

In a clean glass still, re-distil some freshly distilled water to which a little sulphuric acid and one or two crystals of potassium permanganate have been added to give it a faint pink colour. In the process of distillation, the pink colour disappears from the water in the still, a little more sulphuric acid and potassium permanganate must be added.

The distillate is collected in a closed glass flask which has been previously prepared by rinsing first with a solution of potassium bichromate and sulphuric acid, then washing out first with distilled water, and then with pyrogen-free water, and finally sterilized by autoclaving.

The pyrogen-free water is sterilized in an autoclave, and may be used for about 3 to 4 days.

transmitted through transfusion. Malaria in a donor is a special danger in this country, especially if the recipient has never had malaria.

Preferably, the donor should be of the same group as the recipient, but a 'safe universal donor', group O (*vide* part XIII), may be used for giving blood to people of all four groups and a 'universal recipient' (group AB) may receive blood from donors of all four groups. The following table shows the groups of suitable donors for different recipients :—

If recipient belongs to group	Donor should be of group
AB	AB, A, B, or O
A	A or O
B	B or O
O	O

In all cases, the cells and serum of the recipient must be cross-matched with the serum and

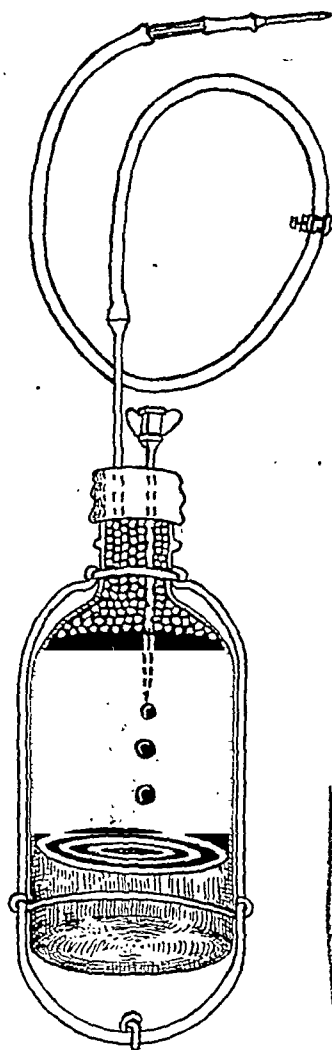


Fig. 4.—Transfusion apparatus in which blood is filtered through glass beads: air or oxygen is bubbled through the blood and helps to prevent the red cells settling.

cells of the selected donor, even when the recipient and the donor are of the same group. After a transfusion this cross-matching of blood between the donor and the recipient must always be done again before another transfusion is given, because the previous transfusion may produce some change in the blood of the recipient which will render it incompatible with the blood of a donor whose blood was found to be suitable before a transfusion was given.

The same donor must never be used for the same recipient after an interval of more than 10 days after the last transfusion, on account of the dangers of an anaphylactic reaction.

A healthy donor of average size can give 500 c.cm. of blood once a

month without any detrimental effect to his health. After such blood-letting it takes 7 days to make good the loss of blood, but the compensatory mechanisms of the body are so efficient that whilst this deficit is being made up the donor will not be conscious of the loss in any way and will be capable of performing his full day's work as usual.

#### Collection of blood

The donor should, if possible, fast for 2 to 3 hours before the blood is taken, because some articles of diet, though innocuous to the donor, may produce allergic symptoms in the recipient.

The donor should be made to lie comfortably on the couch and there should be sufficient light on the selected arm. A sheet of rubber cloth should be placed under the arm.

Put the requisite amount of 3.8 per cent sodium citrate solution (10 c.cm. for 90 c.cm. of blood to be taken or for every 100 c.cm. of the mixture) in the collection bottle, from which the air is now partially exhausted by pumping with a Potain's aspirator syringe, or with a reversed Higginson's syringe if the former is not available. Fit a needle of medium calibre on to the tube attached to the inlet tap and test the negative pressure in the bottle by immersing the needle in sterilized saline and partially opening the stop-cock in the inlet tap, when the saline will be sucked into the bottle. The bottle is now ready for use.

In the meantime an assistant has taken the systolic and diastolic pressure of the donor and the pressure is kept midway between these two readings. The skin over the vein is sterilized with iodine and then swabbed with alcohol to remove the stain of the iodine. Puncture the vein with the needle\* and, when it is in the vein, open the stop-cock in the inlet tap, when the blood will flow freely into the bottle. The bottle is shaken gently so that the blood mixes thoroughly with the citrate solution and does not clot. When the requisite amount of blood has been collected, let out the air from the sphygmomanometer, close the stop-cock, and then take out the needle from the vein. Apply digital pressure over the puncture for a minute or two, seal with tincture of benzoin, apply a sterile dressing, and put on a firm bandage.

Give the donor a drink of cold water or milk, or if he, or she, shows any signs of psychological shock, some stimulant, e.g., sal volatile, or some suitable form of alcohol.

#### Transfusion of blood

Make certain that all the apparatus for transfusion is ready and sterilized before starting the

\* If the vein is not prominent or the operator is inexperienced, it is not advisable for him to attempt to puncture the vein with the needle alone, but to attach it to a syringe; a little blood is drawn into the syringe to make certain that the needle is in the vein; the syringe is then detached from the needle to which the adapter in the end of the collecting tube is quickly fitted. The 'vein seeker' which is sometimes recommended achieves much the same end.

operation. For the method of sterilizing the different parts see below.

Select a good vein and arrange the patient comfortably on the bed with his arm resting on a pillow covered with rubber cloth. Sterilize your hands and fit one end of a piece of sterilized rubber tubing to the bottom of the glass reservoir. A record adapter to which is fitted a needle of small bore is now firmly fitted to a narrow tube about 2 inches long; the other end of this tube is fitted by means of a glass connexion to the end of the long rubber tube attached to the glass reservoir. The glass and the rubber connections, the rubber tubing with the reservoir, glass tubing, and the adapter are now firmly tied with silk. If the transfusion is to be given very slowly, the drip apparatus (figure 3) is incorporated at about the middle of the long rubber tube attached to the glass reservoir. To the rubber tube, a little above the drip apparatus, is attached a pinch-cock to regulate the flow of the transfused fluid.

Wash out the apparatus by pouring sterilized normal saline into the reservoir, drive out the air bubbles in the tube by squeezing the rubber tubing, and see that the saline flows freely through the needle, leaving a little, about 10 c.cm., of saline in the glass reservoir, but, when a drip apparatus is used, manipulate the pinch-cock above it so that the saline flows only in drops through the drip apparatus, and consequently also at the same rate through the needle at the extreme end.

The skin over the selected vein is sterilized with tincture of iodine and an assistant applies pressure with one hand just above the selected vein, in order to make it stand out prominently. The operator now punctures the vein; with a successful puncture the blood from the patient will flow back into the glass tubing, but, when the pressure above the vein is released, the flow is thereby reversed and the saline will pass into the vein. (As in the case of the donor, the puncture may first be made with the needle attached to a small syringe, a little blood withdrawn, the syringe detached from the needle, and the adapter at the end of the rubber tubing from the reservoir fitted to the needle.) When it is seen that the saline is passing into the vein, the citrated blood in the bottle is gently shaken and then poured into the glass reservoir through a few layers of sterilized gauze placed on the top of it.

The rate at which blood is transfused will depend entirely on the circumstances. In a case of acute and serious blood loss, a rapid transfusion is indicated, 500 c.cm. being given in 10 to 15 minutes, but in chronic conditions, especially cases of severe anæmia, the drip-feed method by which 1 c.cm. per pound weight of patient per hour is given, or an even slower rate in which it takes 24 hours to give 500 c.cm., is preferable.

When most of the blood has been given, a little warm saline is added to wash out the residual blood in the reservoir and the tube, the

needle is taken out, and for a minute or so, pressure is applied to the puncture, which is then sealed with tincture of benzoin and a bandage applied over a sterile dressing.

The transfusion by the closed method is possible in all but extremely debilitated patients with very low blood pressure and collapsed veins; in those cases transfusion by the open method is resorted to.

*The open method.*—The vein used for open transfusion is subsequently ligatured and for that reason, and on account of the greater convenience of keeping the leg immobilized for a long time, the great saphenous vein is usually chosen. The leg is immobilized with a splint, the vein is opened, and a Rogers' cannula, which is used in place of the ordinary needle, is inserted into the vein. The cannula is kept in position with adhesive plaster. With this technique blood can be given by the drip method at a very slow rate over a long period, 24 hours or more, without tiring the patient or interfering seriously with his movements in bed.

#### *Cleaning and sterilizing of the apparatus*

Separate all the parts of the apparatus, wash first in tap water, and then syringe tap water through them.

Next wash with dilute solution of soap and rinse thoroughly in water to remove the soap.

Place all the parts in a large pan containing 0.1 per cent NaOH and boil for 5 minutes.

Transfer to another bowl and wash first with distilled water and finally with pyrogen-free water. Allow to dry and pack for sterilizing.

Wash the needle first with water and next with hydrogen peroxide, remove hydrogen peroxide with distilled water, dry in alcohol and ether, and keep it in a vessel containing liquid paraffin.

#### *Sterilization*

(i) Rubber and metal attachments by boiling in normal saline for 10 minutes.

(ii) Glasswares, e.g., bottle for collection of blood, and the glass reservoir for transfused blood—in an autoclave at 120°C. for half an hour or in a hot-air sterilizer at 180°C.

Drainage apparatus sterilized in the same way. Boiling in liquid paraffin for about 10 minutes.

(iv) Cutting instruments—in strong lysol lotion and washing in sterilized distilled water before use.

#### *Reactions after transfusions*

Transfusion of citrated blood is very often accompanied by slight reactions, which are sometimes due to pyrogenic substances present in the apparatus and in the distilled water used for preparing solutions. Reactions after transfusion of stored citrated blood are often more severe than when fresh citrated blood is used. There is seldom any reaction after transfusion of plasma alone.

(Concluded on opposite page)

# OCULAR MANIFESTATIONS DUE TO LACK OF VITAMIN 'A' IN THE SYSTEM \*

(WITH SPECIAL REFERENCE TO THE TREATMENT IN GENERAL PRACTICE)

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It is a well-known fact that as a result of vitamin-A deficiency people suffer from night

\* Rearranged by the Editor.

(Continued from previous page)

Reactions after transfusion may be divided into three groups :—

- (i) due to defects in the donor,
- (ii) due to technical causes, and
- (iii) due to autogenous causes in the recipient.

These reactions will therefore to some extent be avoided by

- (i) careful selection of donors, particularly avoiding allergic subjects,

(ii) following carefully the instructions given above and giving particular attention to the following—washing all the apparatus with normal or citrated saline so that no trace of distilled water is left in any of them, and avoiding excessive shaking, overheating and rapid administration of the blood, and

- (iii) taking action according to the circumstances, as follows :—

*Autogenous causes in the recipient*

*Remedies*

- (a) Susceptibility of the patient to shock  
Lower the head end of the bed, cover with blanket and apply heat to the extremities. If required 0.5 c.cm. of adrenalin chloride may be given hypodermically.

- (b) Allergy  
Adrenalin chloride 0.5 c.cm. hypodermically; calcium by the mouth and by injection; and calamine lotion locally in the case of urticaria.

- (c) Lysis of recipient's blood (generally seen in cases of hæmolytic anæmia)  
An alkaline mixture should be taken before the transfusion, and the transfusion should be given very slowly.

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blindness, and that when the deficiency becomes extreme keratomalacia develops. This deficiency in the system affects the general health and is associated with several other diseases, e.g., boils, etc., with which general practitioners deal every day. With a proper supply of vitamin A along with the diet, or, if required, as medicine, many eyes can be saved from keratomalacia and its complications.

Keratomalacia is one of the commonest causes of blindness in Bengal amongst children below the age of 5 years. It does not develop suddenly, but gradually passes from one stage to the next, from mild to severe forms. It is sad to see patients, especially children suffering from keratomalacia, coming to the eye hospital in such an advanced state that it is often impossible to save the eyes. From the history, one usually ascertains that they were under the treatment of physicians for either gastro-intestinal or liver complaints; or other systemic diseases. In the course of the treatment, when the eyes were affected, they were advised to attend an eye hospital. If the conditions are not very advanced the eyes are saved, but in many of the cases the patients come when they are already blind. During the investigation it has been noted that out of 215 cases of keratomalacia 127 cases (i.e., 59 per cent) came in a late stage.

In this paper the following points will be dealt with :—

- (a) The causes of deficiency of vitamin A in the system.
- (b) Ocular manifestations of vitamin-A deficiency.
- (c) Prophylaxis.
- (d) Treatment of these conditions.

## Ætiology

The causative factor is deficiency of vitamin A in the system. The deficiency may be due to several causes—(i) It may be due to want of a proper supply of vitamin A in the food. Owing to their poverty, a large percentage of people cannot get sufficient food rich in vitamin A, e.g., milk, butter, green vegetables, etc. An insufficient supply of milk to children is one of the commonest causes of this deficiency.

Owing to ignorance in many cases expectant and nursing mothers are not properly supplied with sufficient milk in their diet. In the case of children this deficiency is commonly due to insufficiency or absence of breast feeding. Where breast feeding is inadequate, artificial feeding very often is deficient in vitamin A. In many cases of systemic diseases patients' diet does not contain sufficient vitamin A, and in the course of the disease the eyes are affected.

(ii). The supply may be sufficient but absorption into the system may be deficient. Intestinal disorders, e.g., diarrhoea, dysentery, colitis, etc., and liver disease, e.g., obstructive jaundice, cirrhosis, etc., interfere with absorption of the fat-soluble vitamin A.

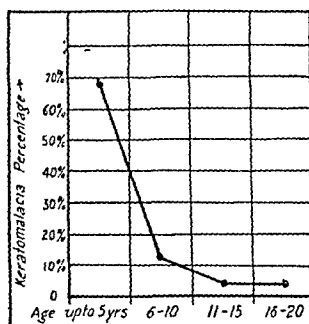


Excessive utilization of vitamin A in the system, as in acute infectious conditions, *e.g.*, typhoid, may cause this deficiency when a proper supply is not maintained.

*Age incidence.*—The milder manifestations are found at all ages, the severe form mostly in children below 5 years; 74 per cent of our severe cases were children below 5 years of age.

#### *Keratomalacia at different ages :*

##### *Distribution of cases*



*Note.*—Only 13 per cent were above 21 years of age.

Gastro-intestinal disorders were present in 78 cases, out of which 68 cases (*i.e.*, 87.16 per cent) were below the age of 5 years.

##### *Keratomalacia*

Up to 5 years	..	141	..	(65.6 per cent)
(a) Up to 1 year	..	55	..	(25.5 " " )
(b) 2 to 5 years	..	86	..	(40 " " )
6 to 10 years	..	24	..	(11.1 " " )
11 to 15 years	..	11	..	( 5.1 " " )
16 to 20 years	..	10	..	( 4.6 " " )
21 and upwards	..	29	..	(13.4 " " )
<b>TOTAL</b>	..	<b>215</b>		

##### *Caste and sex*

Caste		Sex	
Hindu	.. 849	Male	.. 940
Mohammedan	.. 263	Female	.. 194
Christian	.. 22		

*Climatic influence.*—The ocular manifestations due to vitamin-A deficiency are more common in the rainy season, probably owing to frequent attacks of diarrhoea, dysentery, colitis, etc., being more common during this season.

*Incidence in Bengal.*—This is one of the commonest causes of blindness in the province. A large number of people suffer from this condition of deficiency with various ocular manifestations. In five different districts of Bengal (Pabna, Rangpur, Midnapur, Nadia, Khulna) it has been noted that 8.9 per cent show signs of vitamin-A deficiency.

*Signs and symptoms.*—The earliest manifestation of the ocular affection is night blindness (hemeralopia). In the case of children, the parents notice that the children cannot walk in the dark, and are unable to recognize or pick up anything from the ground in the evening, which they could do before. It should be always remembered that night blindness is not always

an indication of vitamin-A deficiency, because in cases of glaucoma, and also in many diseases of the retina, choroid, optic nerve, lens and the vitreous body night blindness occurs. These

Number	Source of cases	Number of cases examined	Deficiency of vitamin A noted from ocular manifestations	Percentage
1	Villages	505	66	13.06
2	Dispensaries.*	529	61	11.5
3	School children.	269	15	5.06
4	Mill workers.	304	17	5.5
5	Jail prisoners.	417	23	5.5
6	Total	2,024	182	8.9

\* Travelling Eye Dispensaries of the Association for the Prevention of Blindness, Bengal.

conditions must be excluded before assuming that night blindness is due to vitamin-A deficiency. In cases of night blindness due to vitamin-A deficiency usually the vision is normal, or can be corrected by glasses to normal.

The second stage of this deficiency produces changes in the epithelium and in the colour of the conjunctiva, *e.g.*, keratinization producing xerosis and Bitot's spots. The loss of lustre and dryness of the conjunctiva with Bitot's spots are usually noted in the bulbar conjunctiva in the palpebral fissure. The xerotic patches are noted usually on the inner and the outer sides of the cornea on the bulbar conjunctiva. Bitot's spots are white, foamy, triangular, raised areas situated in the palpebral fissure usually on the temporal side of the cornea. The base of the triangle is towards the limbus and the apex is towards the outer canthus. The pigmentation is most marked at the limbus and spreads to the fornices of the conjunctiva. These changes are not necessarily due to vitamin-A deficiency and are probably associated with other vitamin deficiencies. In many cases with these manifestations, the dark-adaptation tests reveal no vitamin-A deficiency in the system.

In the third stage there is a diminished sensibility of the cornea. Diminished sensibility of cornea can be tested by touching the cornea with a small point of cotton wool. When the cornea is touched the patient does not respond by closing the eyelids. In advanced cases of this stage there is a general haziness of the cornea. The appearance is not of opacity of the cornea but of diminished transparency.

In the fourth stage a number of areas of degeneration appear in the corneal structure—the deep layers of the cornea. They appear as grey areas, crescentic in the periphery and circular in the central region. Multiple areas may develop at the same time. The areas of

degeneration very quickly break down, leading to the next stage.

In the fifth stage the cornea breaks down. This is due to degeneration of the corneal tissue. The breaking down is not associated with an inflammatory reaction in the eye, in the absence of secondary infection. The cornea rapidly disintegrates, leading to perforation with prolapsed iris. This is the reason why it is called keratomalacia (softening of the cornea).

The sixth stage is one of blindness. The cornea has completely broken down leading to phthisis bulbi, anterior staphyloma, in the absence of infection or panophthalmitis in the presence of infection.

### *Prophylaxis*

*Babies.*—A sufficiency of milk and butter in the diet of expectant and nursing mothers is essential; otherwise one teaspoonful of cod-liver oil or fish-liver oil twice daily should be taken. This will ensure there being sufficient vitamin A in mothers' milk, a large amount of which is required by the growing child. Mothers' milk is the best food for babies, if mothers' milk is not available humanized cow's milk with a little vitamin A in the form of two drops of adexolin or halibut-liver oil twice daily should be given.

*Children and adults.*—Sufficient milk, butter, eggs, green leafy vegetables, etc., should be taken in the diet. In many cases people cannot afford milk and eggs. They should be advised to take plenty of green leafy vegetables (e.g., *palang shak*, *puin shak*, cabbages, etc.), carrots, fresh fruits and fish.

### *Principle of treatment*

1. To supply sufficient vitamin A and ensure its absorption into the system as soon as possible

- (a) with diet,
- (b) as medicine—
  - (i) oral administration,
  - (ii) parenteral administration,
  - (iii) by inunction.

2. To treat local conditions of the eyes.

3. To treat gastro-intestinal, bronchial and liver complications.

*Oral administration.*—In the absence of any liver or gastro-intestinal disorders vitamin A in the form of cod-liver oil, adexolin, halibut-liver oil or, medicinal fish-liver oil\* should be used.

*Inunction.*—The skin of the chest back, axillæ and groins should be cleaned with

soap and tepid water and the areas should be thoroughly dried with a towel. One drachm of pure cod-liver oil or medicinal fish-liver oil (Shaliverol) should be rubbed into these areas gently for a few minutes and the child put in the morning sun daily.

This method of treatment is not so satisfactory as parenteral administration, but it is useful when vitamin-A concentrate suitable for intramuscular injection is not available.

*Parenteral administration.*—To get a prompt and satisfactory result, parenteral administration of vitamin-A concentrate should be used without delay. For this purpose 'Prepalin' (Glaxo Laboratories) parenteral vitamin A (1 c.cm. contains 100,000 I. U.) can be used. It is used intramuscularly into the deltoid or the gluteal muscles. The dose for a child will depend on the development of the muscle into which the medicine is injected, e.g., 1 c.cm. into a well-developed gluteal muscle. Prepalin is obtained in 1 c.cm. ampoules, 0.5 c.cm. can be injected into children. Injections should be at one week's interval. Two or three injections are sufficient for curing the condition. In the case of an adult 1 c.cm. should be used at a time. The site of the injection should be gently massaged, and a warm compress advised over the area, specially where the muscles are weak and thin, as in emaciated children. In the presence of an inflammatory reaction in the area, a second injection should be given on the second day in another area, because in the presence of inflammation the absorption of vitamin A may be interfered with.

### *Treatment of eye complications*

Along with the injections, the local conditions in the eyes require treatment. In the absence of secondary infection, local treatment in the first four stages is not necessary. In stages III and IV liquid paraffin drops twice daily should be advised. In stage V where corneal ulcer has developed, atropin ointment  $\frac{1}{2}$  per cent is put in once each morning, and if there is secondary infection the eyes should be washed repeatedly with warm normal saline lotion and protargol 5 per cent dropped in once a day. If perforation is threatening (in the absence of secondary infection) the eyes should be banded.

The treatment mentioned above is very efficacious and gives very good results in all cases up to early cases in stage V, but, in advanced cases in stage V and in all cases of stage VI in which the eyes are already blind, practically nothing can be done to save the eyes. Treatment is then carried out only for the patients' general health.

### *Treatment of diarrhæa in children*

(1) Stop all feeds for 24 hours. Water may be given freely, if necessary sweetened with

\* Medicinal fish-liver oil can be obtained from the Director of Industries and Commerce of Madras and Shaliverol from the Director of Marine Biology, Travancore.

a little saccharine or *tal misri* (sugar candy of palm juice).

(2) Mild laxative :—

R̄

Sodii sulphatis gr. x

Sodii citratis gr. v

Syrup m̄ x'

Aquam ad 5ii

Give this 2- or 3-hourly, 3 or 4 doses according to response. If there is much watery purgation kaolin gr. x may be added to each dose.

(3) Skimmed milk—with sugar of milk and sodium citrate if needed.

(i) Skimmed milk—4 ounces.

(ii) Water—4 ounces.

(iii) Sugar of milk (or *tal misri*) 2 teaspoonfuls. Feed the child 3-hourly.

When diarrhoea is cured, humanized cow's milk with a little vitamin A in the form of a quarter teaspoonful of cod-liver oil in each feed is advised.

Milk—4 ounces.

Water—4 ounces.

Sugar of milk (or *tal misri*)—2 teaspoonfuls.

Cod-liver oil— $\frac{1}{4}$  teaspoonful. The cod-liver oil is gradually increased according to tolerance.

*Skimming of milk.*—One pint or one quart of fresh milk is placed in a glass douche can in a cool place. The milk is allowed to stand for some time when the main cream content will settle in the upper layers. The lower three-quarters are syphoned off; this is skimmed milk (proportion—protein 3 per cent, sugar 4.8 per cent, fat 0.5 per cent, calorie value 10 per ounce).

My thanks are due to Lieut.-Colonel E. O'G. Kirwan, C.I.E., M.D., F.R.C.S.I., I.M.S., professor of ophthalmic surgery, Medical College, Calcutta, and to Captain K. Sen, M.B., F.R.C.S.E., D.O.M.S., honorary ophthalmic surgeon, Eye Infirmary, Medical College Hospitals, Calcutta, without whose help and guidance the production of this paper would not have been possible.

My thanks are also due to the staff of the Eye Infirmary, Medical College, and to Mr. H. C. Mukherjee, for their co-operation and help.

## Medical News

### MEDICAL ETHICS

According to the resolution passed at the meeting of the general body of the Bombay Medical Union held on 7th April, 1941, two lectures on medical ethics are being circulated.

The question of observance of medical ethics by our colleagues all over India and especially in the Bombay Presidency, has been engaging the attention of the managing committee and different members of the Bombay Medical Union from time to time, for over 40 years.

From the very beginning as far as we know, there has been no teaching on this subject for students or post-graduates. It is very necessary that all our colleges should make provision to enlighten students and their colleagues on this subject before they are turned into medical men. They must be trained in their professional life. In no circumstances can we treat our profession as a mere trade. Not only is the teaching on the subject entirely omitted but what is worse the students and post-graduates see that some of their own teachers and leaders of the profession very often indulge in indirect practices of publicity and advertising in the lay press. Is it any wonder that they imitate the example of their teachers, in their professional life?

Fortunately, to our knowledge, there are a few honourable exceptions, who in spite of the provocations of their colleagues and in spite of great financial loss thereby, have stuck to the principles of professional honour and respect during the whole period of their careers. They deserve our greatest respect and admiration. As far back as 1910, our president Dr. Bacha had occasion to send a 'disclaimer' to the British Medical Journal because a few papers in Bombay had taken notice of his having obtained the Fellowship of the Royal College of Surgeons and at the time he sent a private warning to the papers not to publish anything of his professional career in future. As Dr. Bacha has been our president for the last two consecutive years the secretaries thought it worth while to request him to give a few lectures on the subject to the members of the Bombay Medical Union.

Instead of treating the subject in general only, he has very wisely stressed and emphasized the evil practices which are rampant in our profession. To our great surprise and satisfaction almost all the members who attended the lectures were unanimously of opinion that some practical ways and means should be found to discourage and stop these practices altogether.

The Bombay Medical Union has already appointed a sub-committee with this object. As Dr. Bacha says, we have a profession equal to any in the world as far as our skill and abilities are concerned; then, why should we be failing in the eyes of the medical fraternity of the world, in matters of medical ethics?

### ADENWALLA MEDAL AND PRIZE IN OPHTHALMOLOGY

The committee of the All-India Ophthalmological Society announces that the subject for the next award of the Adenwalla medal and prize in ophthalmology will be 'Changes in the cornea due to malnutrition'. The prize will be awarded to the best work on the above subject and is open to all ophthalmic specialists resident in India. The essays must be submitted to the secretary, All-India Ophthalmological Society, before the 15th November, 1942.

### ORDER OF THE HOSPITAL OF ST. JOHN OF JERUSALEM

THE King has been graciously pleased to sanction the following promotions in, and appointments to, the Venerable Order of the Hospital of St. John of Jerusalem:—

#### As Commanders (Brothers)

Major-General Sir Gordon Gray Jolly, Kt., C.I.E., I.M.S., M.B., D.P.H.

#### As Officers (Brothers)

Lieut.-Colonel Frederic Allan Barker, C.I.E., O.B.E., I.M.S., (Retd.).

## Public Health Section

### REORGANIZATION OF THE MEDICAL AND ALLIED SERVICES IN GREAT BRITAIN

TOWARDS the close of the Great War of 1914-18, the inadequacy of the organization for the provision of medical and public health services came to be recognized by almost all the progressive national governments. The growth of knowledge that had taken place resulted in making more complex the measures necessary for combating disease and ensuring health. This resulted in increased cost of treatment, if the full range of medical service were to be utilized, and the bulk of the populace could not afford to pay for the specialist and other services required. Consequently, in order to bring the advantages of medical knowledge within reach of all citizens, it came to be recognized that the health of the populace should be a direct concern of the government.

In pursuance of this recognition, the Consultative Council of the Ministry of Health on Medical and Allied Services in Great Britain, 1920, drew up a scheme the aim of which was to make all the best means of maintaining health and curing disease available to all citizens. The main features of the scheme were: close co-ordination of preventive and curative medicine, regionalization of administration by means of primary and secondary units, and close co-ordination of a key-base hospital, wherever possible, with a teaching hospital.

However, as is usual, once the stress and strain of emergency was alleviated there was relapse to *laissez-faire*. It however continued to be recognized that the *status quo* was unsatisfactory and the passage of the Local Government Act of 1929 and the formulation of various schemes, particularly that of the British Medical Association in 1938, were the significant indications of this recognition. These, however, were of a fragmentary nature and could only ensure partial relief.

The stimulus of the present war is again focusing attention on the weaknesses of *ad hoc* medical organization. Significant steps are in process of initiation to remedy the situation. The Nuffield Provincial Hospital Trust gave effect early in 1940 to a scheme, in essence comparable to that adumbrated by the Consultative Council of the Ministry of Health in 1920. Three regional councils have been constituted for Berkshire, Buckinghamshire and Oxfordshire; Devon and Cornwall; and Northumberland, Durham and parts of the North Riding of Yorkshire. Regional medical advisory committees have been constituted in each of these three regions and in Scotland. It is also of particular interest to note how this stimulus has affected the medical profession itself as is

evidenced from the summary of the report of the special committee appointed by the West Somerset Medical Club to plan a scheme of post-war medical services—published in the Supplement to the *British Medical Journal*, 26th July, 1941—and which also conforms in general principle to the 1920 report. One naturally awaits with great interest the scheme that will be forthcoming from the Planning Commission of the British Medical Association set up in January 1941, the terms of reference of which are 'to study wartime developments and their effects on the country's medical services, both present and future'.

Sir Arthur Newsholme may prove to be one of those individuals who lives to see the fulfilment of his own prophecy in his own country. Sir Arthur defined the necessity for the socialization of medicine as the rendering available for every member of the community, irrespective of any necessary relations to ordinary conditions of individual payment, of all the potentialities of preventive and curative medicine. The trend in the past twelve months in England is increasingly towards the socialization of medicine. The development in New Zealand, noted elsewhere in this issue, is of significance in this respect.

### PUBLIC HEALTH ADMINISTRATION

#### COURSE OF PUBLIC HEALTH EVENTS

##### I. NEW ZEALAND MEDICINE

(Extract from *Medical Care, Summer Issue, 1941, p. 262*)

NEW ZEALAND has a long tradition for advanced social legislation and one of the lowest death rates of any country in the world. In 1938 a comprehensive Social Security Act was passed, consolidating the already established unemployment insurance, old age, widows' invalidity, and other benefits, and adding a programme of medical care. The 'social security fund' out of which all these services are supported is built up partly by payments from employed persons, matched more-or-less equally by payments from general taxation.

Under the law, the 'health benefits' are administered by the Ministry of Health, and are 'available to all persons ordinarily resident in New Zealand without regard to economic status, race, or nationality'. They include (1) 'Medical benefits', i.e., care by a general physician; (2) Hospitalization; (3) Maternity care; (4) Ordinary drugs and medicines; and authority was given for adding, when practicable, specialist services, dentistry, home nursing, and domestic assistance.

*Maternity care.*—Opposition by the medical association which includes about 90 per cent of the 1,500 physicians of New Zealand, caused the Ministry of Health to defer the medical benefits and to start with maternity care, 15th May, 1939. Every woman is entitled to the services of a physician, home nursing, and two weeks' hospital care, if necessary. She has free choice of doctor, hospital, or nurse. 'Every doctor undertaking maternity work in the course of his practice will be entitled to receive payment from the social security fund . . . according to a scale of fees fixed by agreement between the Minister of Health and the Council of the . . . Medical Association.' Nearly all physicians who do any obstetric work have agreed to carry on under the scheme. Patients who employ officially recognized specialists in obstetrics may be

charged extra fees. Mothers may go to either governmental or private hospitals. The latter are paid fixed fees from the social security fund. 'The services of anaesthetists and consultants are also provided for' . . . (and) . . . 'medical services in relation to miscarriage, provided the patient has received approved ante-natal advice before the occurrence of the miscarriage'.

**Hospitalization.**—New Zealand has a developed system of public hospitals, governed by locally appointed boards and with salaried medical staffs, like the corresponding hospitals in England. There are also voluntary hospitals. 'Hospital benefits' under the new law went into effect 1st July, 1939. Public hospitals are paid from the social security fund a fixed *per-diem* rate (6 shillings) for each patient who receives without charge medical and surgical attention as well as nursing and maintenance. Certain services are also available to out-patients. If the patient wishes to go to a voluntary hospital, he may do so. The hospital is paid the same rate from the fund and must apply that payment against its usual charges to the patient. Of the hospital and maternity benefits a New Zealand health official wrote last autumn that they were 'in smooth and efficient operation'.

**Physicians' services.**—Objections from the medical association caused the operation of this section of the Act to be postponed. In 1940, the law was amended, and in its new form was promulgated as in effect in May 1941. Services are for the present limited to those of general practitioners. There is free choice of doctor and freedom on the part of the doctor to accept or reject any patient.

Physicians are remunerated on a capitation basis, *i.e.*, so much per year for each patient on his list (at present 15 shillings), *plus* mileage fees when required. Specialist services, being beyond the present scope of the scheme, must be paid for by private arrangement between specialist and patient. Professional advisory committees are provided for. Ordinary drugs and medicines are also paid for by the social security fund. This section of the Act was also put into effect in May, after the Ministry of Health had effectuated arrangements with the pharmacists.

An editorial in the *New Zealand Medical Journal* of February 1941, comments in part as follows:—

Under a cloak of innocent voluntarism the amendments . . . are devised to bring the pressure of individual patients, and of organizations of patients, on individual doctors in order to undermine the profession, and to break down the resistance of the association to the socialization of medicine. They are calculated also to promote a spirit of defeatism by fostering distrust amongst neighbour doctors. 'What will B do?' A is supposed to ask himself. 'If he accepts, I shall have to accept too, or lose patients', A is supposed to conclude. There is no compulsion on the patient to present the contract, or on the doctor to accept it—none whatever. The patient has the easy alternative of paying twice, if he chooses; and the doctor may readily prefer to lose practice.

We fully understand that success in these tactics would result in complete bureaucratic control of medicine. Being paid from the social security fund, and governed by the regulations, the profession would be in effect civil servants; but civil servants without hours of duty, leave, promotion, or pension—civil servants without the status, amenities, protection or security of civil servants. Advantage would accrue to those who undertook the greatest number of patients, contenting themselves with physiognomic diagnosis and empirical treatment.

## II. AMERICAN PUBLIC HEALTH ASSOCIATION YEAR BOOK, 1940-41

The single most significant measure of public health practice in the United States and Canada in the annual *Year Book* of the American Public Health Association is the reports of its committees. Generally, these reports lead to the eventual action by the Governing Council of the Association for adoption as standards of practice. The following abstracts from some of the

reports in the 1940-41 *Year Book* are of interest in reflecting the trend of public health administration and practice. The original should be consulted for further details. These year books are a *sine qua non* for workers in public health throughout the world.

### Functions of public-health engineering personnel (Report of Committee on Co-ordination of Public-Health Engineering Activities)

#### A. Nature and scope of public-health engineering—

1. A number of different services are employed in the maintenance of public health, particularly those of two professions:—

- (a) Medical health service which is concerned especially with the effects of environmental conditions upon the human organism and the adjustment of man to his environment.
- (b) Engineering health service which utilizes the materials and forces of nature in the adjustment of the environment to man. When employed primarily for the protection and promotion of public health, this specialized branch of engineering is termed 'public-health engineering'.

2. Public-health engineering includes the public-health aspects of all types of environmental conditions whose control is based upon engineering principles, regardless of the magnitude or technical difficulty of the individual problems involved.

3. All procedures of federal, state, and local health departments that depend upon engineering materials or methods should be considered as public-health engineering activities.

#### B. Personnel—

The preparation of public-health personnel should include opportunities for field experience under supervision. First-hand knowledge of procedures is important. Valuable field experience for public-health engineers can be provided by their employment for the supplementary activities mentioned above as a method of preparation for broader responsibilities.

#### C. Administration and supervision—

All public-health engineering activities should be under the supervision of a competent public-health engineer who should be directly responsible to the administrative health officer for all matters which affect their professional integrity.

### Standards of water purity

(A progress report of the Committee on Waterways Pollution)

Aside from the U. S. Public Health Service standard of quality of drinking waters used by common carriers in interstate traffic, there are no other generally accepted and widely used standards. This standard for drinking waters provides that the *B. coli* index shall not exceed an average of 1 per 100 c.c.m., and that no more than 5 per cent of the samples collected shall have an index of 6 or more per 100 c.c.m. For waters to be purified for drinking purposes, Streeter has formulated the following standards:—

1. Impounded underground waters treated by chlorination only: *B. coli* index shall not exceed 50 per 100 c.c.m.
2. Surface waters being treated by adequate filtration and chlorination processes: *B. coli* index shall not exceed 5,000 per 100 c.c.m.

**Dissolved oxygen.**—In most instances, the dissolved oxygen determination is of most importance. It is well to note that the amount of dissolved oxygen that will barely support fish life varies with combinations of environmental factors at the time and with the size and species of fish. Temperature, pH, and carbon dioxide content are especially important in this connection.

## III. RESEARCH AS A FUNCTION IN MUNICIPAL HEALTH ADMINISTRATION

The level of public-health-laboratory efficiency has long been determined by the quality of the research

produced as a bye-product of routines. It is, however, a marked step forward when public administration appreciates sufficiently the benefits of research to establish separately an institute without any routine responsibility purely for research for research purposes. The City and the Health Department of New York are to be congratulated on this departure whereby an appropriation of \$100,000 has been included in the 1941-42 budget for a new Public Health Research Institute to be used exclusively for scientific research essential for the protection and improvement of health, safety, and welfare, of the people of the city. The institute has been established as a scientific and non-profit-making organization, devoted entirely to obtaining for the city the best available biological products and advanced skill and procedures for combating disease and epidemics. The location of the institute enables it to secure on its Council such individuals, serving in an honorary capacity, as Rivers, Director of the Hospital of the Rockefeller Institute for Medical Research; Opie, Professor of Pathology, Cornell University Medical College; Baehr, Professor of Medicine, College of Physicians and Surgeons; and others from amongst locally eminent medical citizens.

#### IV. MEDICAL SUPERVISION IN FACTORIES

(Extract from *British Medical Journal*, 3rd August, 1940; p. 175)

By the Factories (Medical and Welfare Services) Order, 1940, dated 16th July and published on 29th July, Mr. Ernest Bevin enacts that the occupier of any factory in which is carried on the manufacture or repair of any munitions of war or of any materials, parts, or tools required for such manufacture or repair, or any work on behalf of the Crown shall, if so directed on behalf of the Minister by the Chief Inspector of Factories, or by any other inspector of factories expressly authorized by the Minister to give directions under this Order, make arrangements to the satisfaction of the inspector by way of the whole or part-time employment of such numbers of medical practitioners, nurses, and supervisory officers as the inspector may specify for one or more of the following services: (a) medical supervision of persons employed in the factory in the aforesaid manufacture, repair, or work; (b) nursing and first-aid services for such persons; (c) supervision of the welfare of such persons. The Order came into force on 16th July.

#### *Duties of the works medical officer*

(Extract from *British Medical Journal*, 30th November, 1940, p. 755)

The factory department of the Ministry of Labour and National Service has issued a brief memorandum on medical supervision in factories. It sets out under nine headings the principal duties of a works medical officer. They cover much the same ground as the fifteen paragraphs in the resolution on this subject passed by the Annual Representative Meeting at Belfast in 1937, the year of the passing of the Factories Act. The duties of the officer as set out are briefly as follows:—to be responsible for the organization and supervision of first-aid services in the treatment of injury and sickness; to examine medically and advise persons referred to him by the management or individual employees who consult him; to assure himself of the fitness or otherwise of persons returning to work after illness; to advise the management on general hygiene in the factory; to co-operate on all matters affecting the health of the work people; to maintain an effective liaison with outside health services, including the medical practitioner services; to keep records of sickness and absenteeism; to promote the health education of the work people, and to assist in the A.R.P. services.

(Concluded at foot of next column).

#### INDUSTRIAL HYGIENE

#### A PRELIMINARY SURVEY OF THE INDUSTRIAL HYGIENE PROBLEM IN THE UNITED STATES. PUBLIC HEALTH BULLETIN NO. 259, UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, 1940

Information provided by this bulletin shows that certain occupational groups experience excessively high mortality and morbidity rates, especially from respiratory diseases and from certain degenerative conditions. Some types of physical impairment are found to be more prevalent among occupations involving heavy manual labour. The data definitely indicate a need for a survey of the industrial hygiene problem in the United States.

In the development of industrial hygiene services in State and local health departments, the first step was a definition of the problem through an industrial hygiene survey. Surveys were made in certain States during the period 1936-39, which covered such items as existing health services in industrial establishments, exposure to materials and conditions which might influence health, and an inventory of control measures in use.

The present study is an analysis of such surveys conducted in 15 States, covering 16,803 plants, employing 1,487,224 workers. It is felt that the sample is sufficiently adequate and representative of industrial conditions in this country to warrant considering the data applicable to all industrial establishments of the type studied in the United States.

With reference to safety provisions, it appears that only 25.6 per cent of the workers had the services of a full-time safety director. Hospital facilities were found to be available to only 15 per cent of the workers, and first-aid rooms were provided for 51 per cent. Full-time services of a physician were available to 15.5 per cent, while full-time nursing services were provided for 33.3 per cent of the employees. The analysis revealed that although accident records were kept on nearly all workers, sickness statistics were available for only 45.4 per cent of the employees. For practically all of the health services now considered desirable, the larger plants were found to have these more frequently than the smaller plants.

(Continued from previous column)

#### V. THE CHEMICAL AND MECHANICAL PREVENTION OF SYPHILIS AND GONORRHOEA

Preliminary statement by the special joint committee appointed by the American Social Hygiene Association and the United States Public Health Service

(*Journal of American Medical Association*, 5th October, 1940, pp. 1185, et seq.)

This committee, in reviewing the status of chemical and mechanical prevention of venereal disease, emphasizes that these means are entirely supplementary to prophylaxis through other channels. The review of the present status led the committee to make the following specific recommendations.

1. Safest method—
  - A. Use of condom of standard type.
  - B. Thoroughly wash the genitals and adjacent parts with soap and water as soon as possible (the sooner the better but within one hour at most) after removal of the condom.
2. In the absence of a condom—
  - A. Thoroughly wash with soap and hot water as already described.
  - B. After urination, inject 6 c.cm. of 2 per cent strong protein silver solution, or other efficient, non-irritating germicidal solution into the urethra and hold for five minutes.
  - C. Rub 33-per-cent ointment mild mercurous chloride (calomel ointment) into the genitals and adjacent parts.



The analysis of exposures of workers to various materials and conditions of health significance showed that slightly more than 1,000,000 persons are exposed in this country to the inhalation of silica dust and one and one-half million persons to silicate dusts. Of the various exposures to metal dusts and fumes, the analysis indicates that approximately 800,000 persons are handling lead and its compounds, 34,000 are exposed to arsenic and its compounds, and nearly 33,000 were found to be handling mercury and its compounds. The highest exposure of all was in connection with the agents known to produce dermatitis.

An analysis of the control measures now available for the protection of workers against the exposures found in the survey shows that much still remains to be done in this country for the protection of workers against industrial health hazards. Examination of control measures for 1,503,204 exposures shows that 14.3 per cent were provided with local exhaust ventilation, 3.2 per cent with enclosed operations, 3.2 per cent with respiratory protective devices, and, in the case of certain dusty trades, wet methods were employed in connection with 3.4 per cent of the exposures.

From the analysis of the survey in the 15 States, certain conclusions and recommendations were possible. These deal primarily with the establishment of industrial hygiene programmes in industry and in official agencies.

The most interesting parts of the bulletin relate to a programme for industry largely under private enterprise and a programme for an official state agency. These two sections of this interesting bulletin are quoted below *in toto*:—

#### *A programme for industry*

Corrective measures in industry for the protection of the health of workers are accomplished by private effort and private funds. The important task for any industrial hygiene administration is to persuade industry to solve its own health problems. The official agency mainly serves in aiding industry to evaluate its problems, suggests ways and means for their control, develops standards of good practice, furnishes technical guidance and conducts educational programmes. In those industrial establishments capable of maintaining their own industrial health service, the functions of such services have been said to be as follows:—

1. Regular appraisal of plant sanitation.
2. Periodic inspection for occupational disease hazards.
3. Adoption and maintenance of adequate control measures.
4. Provision of first aid and emergency services.
5. Prompt and early treatment for all illnesses resulting from occupational exposure.
6. Reference to the family physician of individuals with conditions needing attention, co-operating with the patient and his physician in every practical way to remedy the condition.
7. Uniform recording of absenteeism due to all types of disability.
8. Impartial health appraisals of all workers.
9. Provision of rehabilitation services within industry.
10. The conduct of a beneficial health education programme.

#### *A programme for an official State agency*

In assisting the States in the development of their programmes, the Public-Health Service has advocated the following functions:—

1. Consultation with plant management regarding needed corrections of environmental conditions.
2. Advice to the management and medical supervisor as to the relative toxicity of materials or processes, and advice concerning new materials prior to their introduction into the industry.
3. Assistance in developing, maintaining, and analysing absenteeism records.
4. Consultant service to medical supervisors, private physicians, compensation authorities, and other State agencies regarding illness affecting workers.

5. Provision of necessary laboratory service of both a clinical and a physical nature.
6. Integration of the activities of other public-health bureaux in their programmes for workers; for example, the control of cancer, syphilis, and tuberculosis.

The determination of the scope and nature of the industrial health problem in a given locality has been determined in most of the States and is the subject of the present report. The fundamental information of the sort presented herein forms a basis for many of the activities just listed. To accomplish these activities successfully, it will be necessary to integrate the work of the industrial hygiene division not only with other health services in the health department but with the work of other State agencies concerned with health matters and with non-official

### PUBLIC HEALTH REPORTS

#### REPORT ON THE WORKING OF THE HARCOURT BUTLER INSTITUTE OF PUBLIC HEALTH, RANGOON, FOR THE YEAR 1940

DURING the year under report, Government was pleased to sanction the entertainment of a full-time sub-assistant surgeon of the Public Health Department, who has hygiene qualifications, to act as a special tutor for the public health inspectors training course. This arrangement proved to be highly satisfactory not only in respect of efficient teaching, but also in proper maintenance and upkeep of teaching materials. A noteworthy feature of this year's training of public health inspectors was that, coaching classes were held by the special tutor on all working days. The long-felt need for a whole-time demonstrator, who could devote his time solely to teaching work, was fulfilled during the year under report.

The demand for cholera vaccine was heavy during the year. The total number of doses of bulk vaccine manufactured was 834,095, as against 210,125 of the previous year. Approximately 700,000 doses were filled in ampoules and issued to the store-keeper for distribution, against 235,965 doses of the previous year. The technique employed for the preparation of this vaccine was the same as in previous years.

#### MALARIA BUREAU

**Spleen census.**—The reports received from 25 districts comprising 79 townships and 274 villages were recorded. During the year, 12,892 fish were produced in the central hatchery. Eight thousand six hundred and fifty-one fish were distributed to various parts of Burma, either for breeding purposes or for introduction into water collections, as an anti-mosquito measure.

**Quinine distribution.**—Approximately 63,252 treatments of cinchona febrifuge were distributed as against 177,942 in the previous year. The decrease was due to a restriction placed on free distribution of quinine.

**Chemical laboratory.**—A total of 1,035 samples, comprising 393 samples of water, 12 samples of effluents, and 630 samples of foods, drugs and other miscellaneous articles, were examined during the year.

**Toddy-drinking—its influence on the incidence of cholera.**—Toddy-drinking is very prevalent in Burma. A belief exists that in many cases, the onset of cholera takes place soon after toddy-drinking. An investigation was undertaken to verify this.

Toddy is taken either when it is sweet, and unfermented, or in the fermented state.

Histories of cholera cases recorded during the period, January to August 1940, were examined. Out of 407 cases recorded, only 10 gave the history of drinking toddy before the onset of the disease. Of these, in seven cases, the infection could definitely be traced to sources other than toddy. It is therefore difficult to incriminate toddy-drinking by itself, for the onset of cholera. Toddy, however, acts as a laxative and may thus hasten the onset of symptoms in previously infected persons.

# REPORT ON THE PUBLIC HEALTH ADMINISTRATION OF THE CITY OF RANGOON, FOR THE YEAR 1940

The total number of deaths registered during the year was 13,569 compared with 11,327 in the previous year, notifiable diseases being responsible for the increase of 350 and other principal diseases for 1,892.

The death rate calculated on the census population of 1931 was 33.89 per mille compared with 28.29 in the previous year. This is a considerable over-estimate as the census population of 1941 is 501,488 and the death rate based on this comes to 27.06. The Burmese, Hindu, Mohammedan and Chinese were the chief communities amongst which higher death rates were noticed when compared to the previous year.

The number of deaths from cholera was 46 compared with 11 during the year 1939, the average number of deaths for the last 10 years being 17.

There were 354 deaths from smallpox against 68 during the previous year and an average of 97 deaths for the last ten years. To cope with the epidemic of smallpox, besides the adoption of usual preventive measures, special stress was laid on the organization of a successful vaccination campaign. In the months of January, February and March, 180,673 persons or 46.33 per cent of the total population of this city were vaccinated. The effects of the vaccination campaign were striking. The number of smallpox cases which in February was twice that of January, decreased by nearly half in March. The months of April and May showed progressive decline.

There were 7 from plague compared with 6 in the previous year, a decennial average of 18. Ten deaths from measles were recorded during the year. There were 7 deaths from diphtheria against 17 in the year 1939. The number of deaths from cerebro-spinal fever was 17 compared with 16 during 1939, the average for the last ten years being 10. The number of deaths from beri-beri was 60 compared with 116 during the previous year. The average number of deaths for the last ten years was 105. Sixty-four deaths from enteric fever were recorded against 85 during the year 1939 and the average for the last ten years was 63 deaths. The number of deaths from pulmonary tuberculosis showed an increase of 111, there being 743 against 632 during the previous year. The average number of deaths for the last ten years was 829. Puerperal septicæmia accounted for 16 deaths as compared with 21 in the previous year.

The number of deaths from diarrhoea and dysentery was 1,141 against 728 during the previous year. During the rainy season there was an epidemic of bacillary dysentery.

Influenza caused 2 deaths only against 5 during the previous year. There has been an increase of 563 deaths from diseases of the respiratory system—there being 3,211 compared with 2,648 during the previous year. The number of deaths from malaria was 157 compared with 121 in the previous year.

The number of births reported was 12,519 compared with 11,511 in the year 1939, the birth rates calculated on the census population of 1931 for the years 1939 and 1940 being 28.75 and 31.27 respectively.

The infantile mortality rate was a little higher, being 275.05 compared with 270.52 during the previous year. The total number of deaths of infants under one year of age was 3,442 compared with 3,114 during the year 1939—an increase of 328.

The important causes of infantile mortality were, as usual, convulsions, bronchitis and pneumonia, premature birth, malnutrition, dysentery and diarrhoea.

Four thousand six hundred and seventeen infants were under the care of maternity and child-welfare scheme of this department and out of these 564 died giving a mortality rate of 122.16 per 1,000 against 133.05 in the year 1939.

The tuberculosis dispensary continued to function. The number of new patients and the total attendance being 6,485 and 42,213 respectively compared with 4,927 and 38,039 during the previous year.

The anti-mosquito work continued on the same lines as in previous years. Almost all the tanks in the city have been made mosquito-proof. In the suburban area, owing to the lack of co-operation of the public, the desired improvement could not be effected. The corporation, towards the end of the year, sanctioned on a permanent basis the staff employed to combat the mosquito problem.

## BENGAL PUBLIC HEALTH REPORT FOR THE YEAR 1939. By LIEUT.-COLONEL A. C. CHATTERJI, M.B., D.P.H., I.M.S., DIRECTOR OF PUBLIC HEALTH

*Vital statistics.*—The number of births registered during the year was 1,597,651 compared with 1,521,254 in the preceding year. The deaths in 1939 numbered 1,090,530 against 1,315,886 in the previous year. The death rate being 21.9 per mille and 17.0 per cent lower than that in the previous year.

Against the quinquennial averages of 32.1 birth rate and 24.4 death rate, both the birth and death rates for 1939 showed a decrease of 0.3 and 10.6 per cent, respectively. Calcutta was the solitary district in which deaths exceeded births.

*Infantile and maternal mortality.*—The total number of infantile deaths in 1939 was 234,301 compared to 280,923 in 1938. The infant mortality rate per thousand births fell to 146.6 from 184.7 in 1938.

Maternity and child-welfare work is mainly a responsibility of the local bodies towards which Government made annual grants, inclusive of a grant for the training of *dais* and provided for training pupil nurses and *dais* in the state and private hospitals. Suitable recurring grants-in-aid were also given to certain maternal and child-welfare centres and towards educative propaganda through the Bengal Health Welfare Committee. With a view to encouraging the opening of maternity and child-welfare centres in rural areas and with the object of securing substantial development of the service, a moderate scheme for establishment of maternity and child-welfare centres providing a minimum standard of efficiency regarding staff, equipment, buildings, etc., was framed by the Public Health Department. Government approved the scheme during the year under review and offered to make suitable grants-in-aid to local bodies and recognized voluntary associations towards the establishment as well as maintenance of such centres. Government have appointed a lady superintendent for maternity and child-welfare work with the necessary staff, in order to promote and co-ordinate the activities of local bodies etc., in this direction.

*Cholera.*—The total number of deaths from cholera during the year under report was 33,221 with a death rate of 0.7 per mille against 71,133 deaths in 1938 with a death rate of 1.4 per mille, showing a decrease of 53.3 per cent over the figures of 1938 and of 41.7 per cent over the average of the previous quinquennium.

*Cholera preventive measures.*—All approved anti-cholera measures were adopted in combating this disease. Anti-cholera vaccine was freely used although the quantity of vaccine and the number of inoculations showed a decline, apparently owing to the fact that the incidence of cholera decreased in the year and to defective organization on the part of the local authorities in carrying out the work of preventive inoculation. As in the year 1938, the Director of Public Health deputed a number of mobile medical and sanitary units or floating dispensaries for anti-cholera and other epidemic work and also rendered assistance to local authorities by lending on requisition the services of medical and sanitary officers during epidemics.

*Smallpox.*—Smallpox took a toll of 7,029 lives in the year under review against 9,289 in the preceding year, the death rate being 0.1 and 0.2 per mille respectively. The mortality from this disease thus fell 50 and 75 per cent compared with the previous year and the previous quinquennium respectively. It represented 0.6 per cent of the total provincial mortality in 1939. The death

rate from the disease during the year was lower than in any other province except Madras and Central Provinces.

The number of persons vaccinated in 1939 was 7,925,382 against 7,843,545 in 1938. The slight increase might have been due to the greater attention paid by the local authorities than has hitherto been the case in the matter of vaccination.

The local bodies would do well to appoint female vaccinators in the rural areas as the *pardanashin* ladies, resent being vaccinated by male vaccinators, with the result that a large percentage of population remain unvaccinated.

**Malaria.**—It is gratifying to observe that there was a reduction of 75,200 deaths in the total mortality from malaria in 1939, compared to the previous year in which 416,521 deaths were registered. The death rate correspondingly came down in 1939 by 18.1 per cent. Malaria was responsible for 49.6 per cent or nearly half of the total deaths from 'fevers' and 31.3 per cent of the total provincial mortality during the year under review as against 50.8 and 31.6 per cent respectively in the preceding year. 99.4 per cent of the total deaths from malaria occurred in the rural areas and 0.6 per cent in the urban areas compared to 99.3 and 0.7 respectively in 1938.

**Kala-azar.**—The disease accounted for 17,056 deaths with a death rate of 0.34 per mille against 21,642 and 0.43 respectively in 1938. The number of deaths in the rural areas decreased by 4,540 from that of the previous year. The decrease was most noticeable in the districts of Jessore, Rangpur and Tippera. The special anti-kala-azar campaign undertaken in the district of Darjeeling was continued during the year under review. Twenty kala-azar treatment-centres and 2 undieted shelters were maintained and 11 medical licentiates and 2 sanitary inspectors were employed for carrying out effective treatment and intensive propaganda work throughout the kala-azar affected areas of the district.

**Special anti-malaria measures.**—The comprehensive malaria survey of representative areas in different parts of the province, which was started in 1937 was concluded in November 1939. The survey and control measures in connection with the anti-*ludlowii* campaign in the vicinity of Calcutta were continued satisfactorily in the Salt Lake area, Budge Budge and the suburban areas with the co-operation of the Corporation of Calcutta and other local authorities and interests concerned.

The special anti-malaria scheme on a five-year plan for the town of Jessore and its adjoining rural areas financed jointly by the Indian Research Fund Association and the Provincial Government was undertaken with effect from July 1939. Various anti-malaria measures were taken up such as filling up of *dobas*, borrow-pits and low-lying lands, kerosinization of tanks and water-pools, rearing of larvicidal fishes, removal of aquatic vegetation from rivers, *khals*, etc., opening of culverts for free flow of water and improvement of drainage.

The system of doling out grants to local bodies for local minor anti-malarial measures which was in practice so long, was found to be largely ineffective and wasteful. Government therefore decided to make larger grants available for expenditure on comprehensive anti-malaria projects of a more or less permanent nature.

**Pneumonia** took a toll of 47,888 lives against 52,258 in 1938, showing a decrease by 8.3 per cent.

**Pulmonary tuberculosis** accounted for 12,422 deaths compared to 14,668 in the preceding year or 0.25 per mille against 0.29 per mille in the previous year. There was thus a decrease in mortality from this disease in 1939. Of the total deaths in the urban areas from this cause in 1939, Calcutta alone was responsible for 69.9 per cent, the death rate being the highest (2.61 per mille) of all districts. No deaths from pulmonary tuberculosis were reported from 20 towns.

As a first step towards the effective control of tuberculosis in the province, a tuberculosis survey of certain selected typical areas—industrial and rural—was sanctioned by Government and two centres, one at Serampore and the other at Barisal, were started during

the year under review. A comprehensive scheme for the control of the disease was also drawn up by the Public Health Department. It comprised three main stages, each stage being expected to be worked out in a period of five years. The Bengal Tuberculosis Association continued to carry on valuable publicity and propaganda work in the province with the usual grant from Government. The Association also trained a number of tuberculosis workers and home visitors during the year.

**Enteric fever.**—There were 8,290 deaths from enteric fever compared to 9,808 in the preceding year. Mortality from this disease however increased in Calcutta by 8.6 per cent.

**Influenza.**—The number of deaths registered as due to influenza went up during the year under report to 2,467 from 2,143 in 1938, the rural areas being responsible for the unexpected rise.

**Cerebro-spinal fever** accounted for 1,721 deaths against 1,337 in 1938, indicating that the disease made a rapid headway during the triennium ending with 1939. The death rate from this disease increased by 155.6 per cent in Calcutta.

**Typhus fever** which is predominantly a disease of the rural areas, has been on the increase since the year 1936. Four thousand four hundred and forty-three deaths occurred due to this disease in 1939 against 4,034 in 1938, showing an upward move by 25 per cent.

**Dysentery and diarrhoea** were responsible for 27,301 and 27,152 deaths respectively, compared to 37,966 and 31,266 in 1938. Of the total provincial mortality in the year under review, 5 per cent was attributed to these two diseases together against 5.3 per cent in the preceding year.

**Leprosy.**—One thousand five hundred and fifty-seven deaths from leprosy occurred in 1939 of which a vast majority, *viz.*, 1,446 were reported from the rural areas. Leprosy is a growing menace in the province for the control of which a provincial anti-leprosy scheme, to be brought into operation by stages in five years, has been formulated. The first item of this scheme, *viz.*, a special course of training of medical and health officers in leprosy and anti-leprosy work was arranged with the British Empire Leprosy Relief Association, since the close of the year under review.

**Fairs and festivals.**—The Public Health Department and the local authorities concerned co-operated with great success in undertaking medical and sanitary arrangements for the welfare of the pilgrims and the prevention of outbreaks of infectious diseases in the chief *melas* in the province. The St. John Ambulance corps rendered valuable assistance at the Ganga Sagar *mela* where of the five cholera cases only one proved fatal. No deaths occurred from cholera either at the Nangalbund or at the Sitakund *mela*. Unfortunately, cholera broke out in an epidemic form at the Tarakeswar *mela* and spread to the neighbouring areas. The epidemic was quickly brought under control as a result of the combined efforts of the Public Health Department and the public health staff of the district board. Of the 14 cases of cholera at the *mela* ground only 3 proved fatal.

**Health propaganda.**—The publicity branch of the Public Health Department was transferred to the newly created Publicity Department of Government with effect from August 1939. The ten touring cinema parties and the Government exhibition van carried on publicity work as usual.

## ANNUAL REPORT OF THE PUBLIC HEALTH COMMISSIONER WITH THE GOVERNMENT OF INDIA FOR THE YEAR 1940

ALTHOUGH the year has been a period of wide unsettlement as a result of the war, in India the peace that we have enjoyed has protected us to a large extent from that deterioration in health which is inseparable from the privations and physical disabilities attendant on war. Apart from the usual local variations in the prevalence of the common epidemic diseases, the year under review was not marked by any abnormal outbreaks of disease.

As was emphasized by the Hon'ble Sir Girja Shankar Bajpai, in his opening address at the third meeting of the Central Advisory Board of Health in July 1940, war, however grim its reality and however imperative its claims, is a passing phase in the course of history, and the maintenance of health activities on the home front must not be neglected. In spite of the demands of war, the activities of voluntary organizations, such as the Indian Red Cross Society and the Indian Council of the British Empire Leprosy Relief Association, continued uninterrupted and their peace time activities were maintained and even extended in some directions.

**Yellow fever.**—Owing to the large expansion of aerial communications and the extension of the war to Africa, the danger of the introduction of yellow fever into India has increased. Measures have, therefore, been taken to avert the possibility of such a calamity. Persons arriving from yellow fever areas have to produce evidence of satisfactory inoculation or spend the incubation period in some non-infectious area before entering India. Persons arriving in India in contravention of this rule are kept in quarantine at Karachi, until a period of nine days elapses after their leaving the yellow fever area. Aircraft arriving from infected areas are compelled to produce a certificate that they have been effectively cleared of insects at either Khartoum or Cairo. Apart from these measures, steps have also been taken to deal with any possible outbreak of the disease in India. The health authorities of the provincial and state governments have been requested to report promptly even suspected cases of the disease. The Central Government will place an expert unit at the disposal of provincial and state governments for the diagnosis of such patients. One of the most important measures in combating an outbreak is the intensive and efficient control of mosquito breeding in the infected area and, in order to ensure this, an expert unit from the Malaria Institute of India will be placed at the disposal of the government concerned. Through the generosity of the Rockefeller Foundation, ample stocks of the vaccine for preventive inoculation are now available.

**Cholera.**—The third meeting of the Central Advisory Board of Health, which was held at Poona in July 1940, discussed the reports of two committees, one on compulsory inoculation of pilgrims against cholera and the other on the control of food adulteration. Both reports were approved by the board and the recommendations of the two committees were recommended for adoption by the provincial and state governments. The report of the committee on the inoculation of pilgrims expressed the desirability of governments selecting suitable festival centres in their areas for trying out a system of indirect compulsion for inoculating pilgrims (successfully adopted by the Government of Bombay at Pandharpur), and of taking certain measures for providing funds and the trained personnel necessary for carrying out mass inoculation.

**Food standards.**—The Food Adulteration Committee divided the problem of controlling adulteration into three aspects: technical, legislative and administrative. In the report submitted to the Board, the committee discussed only the technical aspect of the problem. The others are to be considered shortly. The committee prescribed, and the board recommended the adoption of, standards of purity for individual articles of food and set out the general principles on which the technique adopted for food analysis by the different laboratories in India should be made to conform to uniform standards.

They recommended that a standing committee should be set up, named, 'The Central Committee for Food Standards' to act in an advisory capacity on the lines of the Society of Public Analysts in England and the British Standards Institution. This committee, which will consist of public analysts, health administrators, and representatives of dairying, agricultural and trade interests, will guide provincial and state governments in the formulation of such measures as are necessary for the control of the purity of food supplies.

**Public health laboratories.**—Another subject discussed by the Central Advisory Board of Health was the

proposal that governments should provide laboratories at suitable centres for the free examination of clinical material from cases of infectious disease, sent either by a medical practitioner or by a government medical officer. The board commended for adoption by the governments a plan for providing laboratory facilities, which was set out in a memorandum on the subject submitted to the board by the office of the Central Advisory Board of Health. This plan provides for a central laboratory for each province or state, capable of dealing with the highest type of diagnostic work and research, for regional laboratories for groups of districts, and for laboratories in individual districts. The memorandum also deals with the questions of personnel and of distribution of the cost between the government and local authorities.

The desirability of raising the standard of diagnosis by medical men of suspected cases of infectious disease which they meet with in their practice is unquestioned and it is to be hoped that the governments will now initiate steps to introduce the scheme in some suitable areas in the provinces and states and gradually expand it over the whole territory as and when funds permit.

**Tuberculosis and overcrowding.**—The effect of unhygienic and overcrowded housing conditions on the incidence of tuberculosis has long been recognized by health authorities all over the world, and town planning, slum clearance and the construction of well-ventilated and airy dwellings on such cleared areas have been an important part of the campaign against the disease in all progressive countries. In India, while town planning and slum clearance have been carried out in some of the larger cities by improvement trusts, the beneficial effects of these measures have, in many cases, been largely offset by the indiscriminate construction of insanitary buildings on the cleared areas, through the failure of local bodies to exercise their powers, under the building bye-laws, to regulate house construction. The board therefore urged strongly on all provincial and state governments the necessity, in the interests of public health, for the strict enforcement of building bye-laws.

**Health administration in railways and jails.**—A welcome feature of recent years has been the increasing collaboration between the railway, civil and military health authorities through the establishment of local committees in the investigation of common problems with a view to taking appropriate action for their solution. Another direction in which good results have followed from the co-operation of the railway and civil health authorities is in respect of the measures necessary for safeguarding the health of the pilgrims attending large fairs and festivals.

The Indian railway administrations together constitute the largest employers of labour in India—over 700,000 persons were employed by them in 1938-39. In spite of the wide prevalence of the common infectious diseases such as cholera, smallpox and plague among the general population, their incidence among railway employees and their dependents who live in railway premises is very low.

As regards malaria, the reports of the chief medical officers of the railways show that the gravity of the malaria problem has been recognized and that preventive measures are being carried out.

For instance, the total number of malaria cases treated during 1939-40 in eleven stations on the Madras and Southern Mahratta Railway, where anti-malaria measures were in progress, was 720 as against 6,662 before these measures were started.

The number of days lost by the railway staff on account of malaria during 1939-40 was 23,666 as against 8,111 before the adoption of preventive measures. In regard to the splenic index remarkable reductions have been recorded in these places. In one station the splenic index was reduced during the period from 33.3 per cent to nil.

Referring to the health administration in Indian jails the report shows that the death rate among prisoners has been reduced, within the last 20 years, from 21 per 1,000 in 1921 to 8.9 per 1,000 in 1940. In recent years

the provincial governments have also encouraged general and physical education among the prisoners

and adopted other measures which include lectures in first-aid and health propaganda.

## Current Topics

### Management of Varicose Veins in Private Practice

By I. A. BRUNSTEIN, M.D.

(From *New York State Journal of Medicine*, Vol. XL, 15th June, 1940, p. 918)

SINCE the general practitioner is the first to see the patient, it is important that he be proficient in the correction of varicose veins, for upon his skill and experience the patient's health depends. Treatment of varicose veins is simple and effective and hence may unhesitatingly be advised in the early stages, so as to avoid disabling complications such as varicose eczema, ulcer, phlebitis, and embolism. Instead of waiting until the patient presents himself for treatment of his varicosities only, prophylactic treatment should be encouraged if these are observed during a routine examination. Though the treatment is quite popular, many patients still believe their condition permanent and are surprised to learn that their varicose veins can be corrected.

Every patient undergoing treatment for an associated disease should be examined for the presence of varicosities, and if these are found, no matter how slight, their correction should be suggested. It is gratifying both to patient and physician to observe varicosities resembling a small bunch of grapes or plums slowly disappear after the use of the proper amount of sclerosing solution and compression and to note the disappearance of a long-standing varicose eczema with its distressing pruritus or the healing of an old varicose ulcer after obliteration of the offending veins. A patient of mine with dermatitis hæmorrhagica and chronic psoriasis of the lower extremities, confirmed by biopsy at a large skin clinic, was treated locally for this skin lesion without any improvement until the underlying varicosities were obliterated.

Every practitioner capable of giving an intravenous injection is able to inject varicose veins. However, one rule of safety must be observed: first, ascertain that there are no contra-indications to obliteration of the varices, and, second, start slowly and with caution.

#### *Preventive treatment*

Until recently, treatment was suggested only when the patient complained of pruritus, burning, aching, fatigue, heaviness, and œdema of the extremities and when the varicosities were of sufficient size and number to warrant the use of sclerosing solutions. To-day, my opinion is that the correction of varicosities is justified even when there are no subjective symptoms. After treatment, these patients state that their legs feel lighter, that they can walk farther without undue fatigue, and are rather surprised not to have noticed their previous discomforts. Treatment of the varicosities should, therefore, not be postponed until there is manifest disturbance or actual disability but should be undertaken as a prophylactic measure.

#### *Recurrences following injection treatment*

When suggesting injection therapy, the patient should be advised of the possibility of recurrences and the importance of periodic re-examinations. The need of correction of new varicosities as soon as they appear should be stressed so that the previous abnormal state is not reached.

If ligation is not indicated, the patient should be advised that the combined treatment of ligation of the great saphenous vein and the injection of the varicosities will minimize the possibility of recurrences. It is well known that, even with this combined procedure, recurrences from collateral channels of the superficial

systems of veins may develop. With this treatment the incidence of recurrences has been reduced from about 60 to about 15 per cent, and when recurrences do take place, they are usually delayed and the varicosities less numerous. It is apparent from the reports of various authorities that the advantages of the combined ligation and injection of the saphenous vein have now been generally accepted.

Assurance should be given to the patient that the operation is a simple procedure and that the number of subsequent injections necessary for complete obliteration is often less than one-half the number of injections required in similar cases without ligation. Quite frequently the patient will refuse the ligation but will submit to injections only. In such instances treatment should not be withheld. The patient, having been convinced of the advantage of treatment, may later accept ligation to ensure more permanent results. Thus one avoids discrediting the merit of this treatment and retains the confidence of the patient.

#### *Indications and contra-indications to active treatment*

After a detailed history, minutely investigating the complaint of the patient with special reference to post-operative or post-partum phlebitis, such as phlegmasia alba dolens, a general physical examination and urinalysis should be made. In advanced age, senility, or in the presence of debilitating conditions with short life expectancy, a constructive treatment should be employed. Associated conditions, such as uncontrolled diabetes, cardiac failure, severe anæmia, exophthalmic goitre, should be corrected before treatment is begun. Other conditions such as the menopausal syndrome, prostatitis, or skin conditions, can be treated simultaneously. Pregnancy does not contra-indicate active treatment, but delay is preferable, as treatment may not prevent recurrences even before parturition. Moreover, in the majority of pregnant women, varicosities diminish to such a degree that little, if any, active treatment is required. When injection treatment of varicose veins during pregnancy is undertaken, it should be limited to the larger abnormal veins which cause pain, discomfort or appear to be on the point of rupturing.

In deciding upon the advisability of treatment the physician should rule out local circulatory disturbances and the presence of other conditions that would contra-indicate treatment. Obstruction to venous flow, such as the presence of a pelvic tumour, should be looked for. Advanced arterial deficiency, either arteriosclerosis or thromboangitis obliterans, would contra-indicate the use of sclerosing solutions.

A history of intermittent claudication should make one suspect the presence of peripheral arterial disease. To confirm it, the presence of plantar blanching on elevation, rubor on dependency, diminished temperature, and the patency of the dorsalis pedis and posterior tibial arteries should be looked for. Oscillometric recordings help to indicate the state of patency of the entire vascular bed. In doubtful cases of patients past middle age, a consultation is advisable before sclerosing the veins.

The presence of phlebitis in the deep veins is an absolute contra-indication to injection treatment, as the resulting obstruction of the deep venous flow generally produces a compensatory dilatation of the superficial venous system. The obstruction will usually disappear in six to eighteen months, after which period careful treatment of the varicosities may be instituted. It is, therefore, of greatest importance to determine the patency of the deep venous system.

As a matter of short review it may be stated that the greater volume of the blood from the lower extremity



returns by way of the deep veins. It is from the superficial veins of the leg that varicosities develop, especially from the internal or long, external or short saphenous veins and their tributaries and from the superficial veins of the anterior, posterior, and mesial surfaces of the leg and thigh. Numerous tributaries, normally not noticeable, may develop into medium or large-sized varicosities. There are frequent varicose anastomoses between the external and internal saphenous system. The communicating veins are short vessels, connecting the deep and superficial venous systems. Normally, the flow of blood is directed from the superficial veins to the deep system of veins.

*Tests to evaluate the circulation in the venous system of the lower extremity affected by varicosities*

There are various tests to determine the state of venous circulation in the lower extremities. Of these, Perthes', Brodie-Trendelenburg's and the recent comparative tourniquet test of Mahorner and Ochsner are the most widely employed.

*Perthes' test*

The Perthes' test to establish the patency of the deep venous system consists of applying a tourniquet to the patient's thigh tightly enough to compress the internal saphenous vein. The patient then walks rapidly, and if the varicosities diminish, the communicating and deep veins are known to be open. However, if the deep venous system is obstructed, the superficial veins will become more prominent, and the patient will complain of distress in the extremity. Another test is to bandage the leg from ankle to knee joint with an Esmarch rubber bandage and then make the patient walk for two hours. If no discomfort is felt, the deep veins are open. However, should obstruction be present in the deep system, discomfort and pain proportionate to the degree of obstruction will appear. If the occlusion is complete, the patient will be able to wear the bandage for a short period of time only.

*Trendelenburg's test*

The Brodie-Trendelenburg test determines the competency of the valves of the saphenous and communicating veins. With the patient in the recumbent position, the leg is elevated until the veins are emptied, and a tourniquet is applied near the fossa ovale. The patient then assumes a standing position and the tourniquet is rapidly released. If the veins distend immediately from above, it indicates retrograde flow of blood in the great saphenous vein and incompetency of its valves. This is the positive Trendelenburg test, and there is little danger of emboli from injecting such a vein.

The same test may be used to determine the competency of the communicating veins. If the tourniquet is applied as before and the patient then assumes a standing position, it requires thirty-five or more seconds for the varicosities to distend. The blood has passed through the normal channels of the capillaries, and the valves of the communicating veins are competent. Should the varices fill in less than thirty-five seconds, it indicates that blood, unable to return to the great saphenous vein because of the tourniquet, has returned, totally or in part, by way of the communicating veins with incompetent valves. Accurate information as to the competency of the valves in the communicating veins is necessary to insure good results.

*Mahorner-Ochsner comparative tourniquet test*

The comparative tourniquet test devised by Mahorner and Ochsner is more reliable for the determination of the circulation in varicose veins. For this test, the patient walks to and fro in front of the observer with the lower extremities fully exposed and illuminated by light coming from behind the observer. Even without a tourniquet, the varicosities become less prominent when the patient is walking, as the muscles exert a pumping action on the deep veins, thereby aiding the emptying of the superficial veins. A tourniquet is then applied around the upper third of the thigh, tightly

enough to obstruct the return venous flow in the superficial system of veins including the great saphenous vein. The patient again walks at the same speed. The physician compares the prominence of the varicosities before and after the application of the tourniquet. The same procedure is employed, applying the tourniquet around the middle third, and then around the lower third of the thigh.

The interpretation is as follows: if a maximum diminution in size of the varicosities occurs when the tourniquet is around the upper end of the internal saphenous vein and if there is no further improvement when the tourniquet is around the middle or lower third of the thigh, the valves of the communicating veins are competent, and the only source for retrograde flow is through the main opening of the internal saphenous vein into the femoral vein. In this case, high ligation alone is sufficient. If there is additional improvement, manifested by less prominence, with the tourniquet around the middle third of the thigh and still greater improvement with the tourniquet around the lower third it indicates that the tourniquet is below the lower communicating veins with incompetent valves. In this instance, high ligation alone will be insufficient, and ligation, to be effective, should be below the communicating veins with incompetent valves. Therefore high and low ligation is indicated to reduce the incidence of recurrence. There never is less prominence of the lower varicosities with the tourniquet around the upper end of the internal saphenous than when the tourniquet is around the middle or lower third of the thigh. The interpretation of the Mahorner-Ochsner tests depends upon the degree of prominence of only those veins that are below the level of the tourniquet.

*Sclerosing solution and amount of solution to be used*

The question most frequently asked is: 'What is the best sclerosing agent?' This is to be expected, in view of the great number of solutions. Moreover, every manufacturer extols the superiority of his product. Any solution that has no general toxic reaction and produces effective thrombosis by destroying the intima on contact is a good solution. Phenol, bichloride of mercury, Preg's iodine solution, and mercuric iodide have long ago been eliminated as injection agents because of their dangerous reactions.

A question less frequently heard but of greater importance is: 'How much of the sclerosing solution should be used?' Especially for the first few injections, safety lies in the proper dosage. Experience has taught us to start with a very small initial dose of 0.5 to 1 c.cm. of invertose 60 to 75 per cent or 0.1 to 0.25 c.cm. of sodium morrhuate 5 per cent, gradually increasing the amount in proportion to the reaction to the previous injection and later regulating the dosage to the size of the varicosity to be injected. It is neither necessary nor desirable to obtain occlusion with the first two or three injections. Slow procedure is advisable to avoid unnecessary pain and alarm, and the physician is not annoyed by night telephone consultations. Too often patients are heard to complain of having been bed-ridden for days and even weeks after the initial injection. These patients will dissuade their friends from such a 'dangerous experience' and bring a fairly safe method of treatment into disrepute. One such experience was that of a young physician who, following the package literature suggestions, used 2 c.cm. of quinine and urethane as an initial dose. As a result, the patient suffered massive occlusion of all the superficial varicosities and a swollen leg, and the physician made numerous visits to the bedside of the patient, with nothing more to offer for relief than a prayer for speedy recovery.

Quinine is a strong irritant and therefore is unsuitable for initial injections. It may be employed only when the use of weaker irritants, such as sodium chloride 20 per cent or sodium morrhuate 5 per cent, has failed to produce the desired results. Starting with a small dose of a weak irritant solution is important, because a large percentage of patients with varicose extremities, as noted by Biegeleisen, have infected veins. The



infection may be latent, chronic, or sub-acute, and the use of a large initial amount of sclerosing solution may result in massive occlusion of the varicosities with a severe degree of local and general discomfort.

#### *Injection treatment in the presence of phlebitis*

Phlebitis or thrombophlebitis in varicose veins is evidenced by pain, tenderness, swelling, and slight induration. Thrombosis may precede or follow phlebitis. At times there is increased surface temperature, and in severe cases fever and redness are present. It has been observed by many that upon subsidence of an acute process of thrombophlebitis there is improvement in the condition of the varicosities, probably due to a state of immunity acquired by the patient. This immunity can be produced by injection of small repeated doses of weaker irritants, thus causing a mild acute thrombophlebitis in patients with latent thrombophlebitis. The inflammatory reaction to the irritant in the phlebotic vein is often delayed for five or more days and may occur in distant, non-injected varicosities or along the course of the injected vein. Therefore the presence of latent or subacute phlebitis is no longer a contra-indication to injections if such treatment is carried out slowly and carefully. The initial injection will produce a mild phlebotic reaction, but as one proceeds with increasing doses, the reaction will be similar to that in the non-phlebotic varicosities. Thereafter one may employ gradually increasing amounts of stronger irritants.

In case of extensive acute phlebitis it is advisable to delay treatment until the process becomes quiescent. When there is a history of post-operative or post-partum phlebitis (phlegmasia alba dolens) of one extremity, I begin by injecting the varicosities of the non-affected leg, using mild irritants for the initial injection, and only after some lapse of time is the affected leg treated. It has been my experience that varicosities in a previously involved extremity will react favourably to much smaller amounts of the sclerosing agent than the varicosities of similar size in the non-affected leg. It may be a safer procedure first to inject varicosities of the leg before sclerosing those situated on the thighs. In case there is a thrombophlebotic reaction spread of emboli into upper structures is less likely to occur. After obliteration has safely begun, the amount of sclerosing solution to be used depends upon the size of the varicosity.

#### *Allergic reactions*

The possibility of an allergic reaction should be borne in mind, and a change to a different solution should be made at the first sign of sensitivity. Small initial doses help to avoid severe allergic reactions. A variety of such reactions following the use of sclerosing solutions has been described by various authors. The reaction, as shown by Smith, may produce an erythema of the extremity or of the entire body and may persist over a period of time. Severe allergic reactions are probably caused by a marked idiosyncrasy to the sclerosing solution, and collapse may be due to the sudden entrance of the solution into the general circulation. Some shock generally accompanies the injection in allergic patients varying in degree from a mild fainting spell to a deep surgical shock. Recovery usually follows rapidly. When surgical shock occurs, the systolic blood pressure drops, and the pulse is barely perceptible and at times even imperceptible. Recovery usually follows rapidly.

When injection treatment has been interrupted for a period of several weeks or is undertaken for the correction of recurrences, a new sclerosing agent should be employed, as sensitivity to the former drug may have developed during the interval. If the use of the previously employed agent seems preferable, the same small initial doses must be used.

Pulmonary infarction, mentioned in the literature as another complication, may occur from the fifth to the twentieth day after the injection. The symptoms depend upon the size and location of the infarct.

#### *Technique of injections*

For the injection of smaller varicosities, I prefer the patient to stand so that the varices become more prominent. In medium-sized varicosities, the sitting posture is preferable, unless the site of the varicosity does not permit this, for in the sitting posture the prominence of the varicosity will be diminished and a less protruding thrombus will result. Large-sized varices are best injected with the patient lying down. A tourniquet is applied above the varicosity, the needle is inserted, the tourniquet is removed, and the injection is made into a collapsed vein. Quite often the use of the tourniquet may not be necessary. After the varix has been injected, a gauze pad is applied with sufficient pressure to bring the varicosity to the level of the surrounding tissues. A flat pad is preferable to a cotton ball or gauze sponge, as it will insure smoother compression.

At times it may be advisable to use light pressure with the finger tips upon the varicosity during the injection to avoid the formation of a large protruding thrombus. A number 25 or 26 gauge needle about three-quarters of an inch long with short bevel is best suited for the average-sized varicosity. Longer needles may be necessary for the injection of the great saphenous vein. It will be found advantageous to use separate needles for the aspiration of the solution and for the injection itself. This will avoid possible contact dermatitis in individuals who may be sensitive to the solution employed, and at the same time the sharpness of the needle point is not impaired.

When there is no obstructing factor such as induration or eczema, I prefer to make the puncture about one-third of an inch from the varicosity. The entry into the lumen of the vessel will be felt when the resistance of the vessel wall is overcome. This technical procedure minimizes the possibility of any extravasated sclerosing solution reaching the skin surface. I have employed this technique during the past four years, and I have encountered no case of slough at the site of injection, although others who inject directly over the varicosity have stated that slough formation is also a very rare occurrence. However, I consider the former technique invaluable when injecting extremely superficial, partially intracutaneous varicose veins. These are of a deep blue colour, covered only by a thin layer of skin. It is advisable to introduce the needle parallel to the longer axis of the varicosity, as this makes transfixion of the vein less probable. Dislodging of the needle can be avoided by firm but gentle pressure of the fingers supporting the syringe on the extremity.

Extravasation, periphlebitis, and slough can be prevented by starting the injection in healthy tissue, avoiding puncture of a pigmented, indurated, or eczematous area. The injection of smaller isolated varices, loosely attached to the perivenous tissues, is facilitated by fixing the vessel with pressure or traction on the overlying tissues.

Retrograde flow of blood is to be considered when injecting varicose veins. At times, the reaction will occur at a lower level of the injection, and a protruding thrombus may result. It is therefore better to begin with the injection of the lower varicosities or the lower segment of a varicosity. After having established the tolerance of the patient to the sclerosing solution, I do not hesitate to make multiple injections at one sitting if the nervous temperament of the patient does not contra-indicate it. A diagrammatical drawing of the injected veins with remarks as to the date of injection, dosage, reaction, discoloration, etc., will be of great help and will save considerable time.

One should watch for skin sensitivity to adhesive tape. The patient should be instructed to remove the strapping as soon as he feels intense burning or if a skin eruption develops. Should a mild sensitivity to adhesive plaster be present, I generally insert gauze strips between the adhesive and the skin, leaving only about one inch at both ends of the adhesive fastened to the skin. In cases of absolute intolerance, one must resort to the use of bandages to secure the compressing pad. Following the injection of larger varicosities it

is advisable for the patient to wear a supporting bandage during treatment.

Returning to the question of the choice of sclerosing agents, I have found that sodium morrhuate 5 per cent is most widely used in the majority of the clinics. Sodium chloride 20 per cent is used in one of the oldest clinics in the country, with quinine urethane as the second choice for smaller varicosities. Where sodium morrhuate is used as the solution of choice, treatment is immediately stopped at the first sign of sensitization and another solution substituted. Sodium morrhuate can be given in amounts of 5 c.cm. or more when there is no sign of sensitivity on the part of the patient. In some cases this amount may fail to produce obliteration in a larger varicosity, while a second attempt with the same dosage or an additional 1 c.cm. may be successful perhaps as a result of the previous irritant action upon the intima of the varicosity. Slow injection of the sclerosing solution is helpful in the obliteration of larger varicosities. Rest for 10 minutes in the office, following injection of a larger varicosity, may help to localize the sclerosing solution.

Quinine urethane, a stronger irritant, can also be used in larger amounts after one has carefully determined the tolerance of the patient to this drug. For smaller intracutaneous varicosities, it is best first to try 2 c.cm. invertose 60 to 70 per cent. This is often the safest method for obliterating so-called 'spiderweb' formations. The viscosity of the solution can be diminished by heating the ampoule or vial before use. A characteristic blanching that spreads along a wide net of these veins can be observed when 1 or 2 c.cm. of this solution is injected.

In their latest book, Mahorner and Ochsner mention the use of sodium gynocardate 5 per cent as an efficient sclerosing agent, especially for the larger varicosities or large blood lakes. Sodium morrhuate is their second choice, with quinine urethane or quinine and urea hydrochloride occasionally used especially when treating small intracutaneous or superficial veins.

Monethanolamine oleate, which has a fairly wide safety margin, may also be used in larger quantities. Although other workers have reported allergic reactions, I have not as yet encountered any.

The quantity of sclerosing solution for each injection depends entirely upon the response of the patient to the same or to a different solution employed at the last injection. However, even a carefully measured dose may sometimes produce a severe reaction with extensive occlusion and pain. It may, therefore, prove to be of some value, in certain instances, to caution the patient about the possibility of such an occurrence. For intense pain, cold applications should be applied. The patient need not interrupt his work even if a marked reaction from the injection occurs. Adequate support will minimize swelling and pain.

#### *Discoloration following thrombosis*

Discoloration often occurs after thrombosis of the varicosities. I have observed that this may be lessened in the same patient by changing the solution. Unavoidable discoloration frequently occurs after the injection of a varicosity and, for cosmetic reasons, is objectionable to most women. Having observed that discoloration is only slightly visible after treating patients with sun-tanned extremities, I have succeeded in eliminating this deterrent to treatment by exposing the extremities to artificial sun-ray irradiation.

#### *Technique of ligation*

Ligation of the saphenous vein is best done in a hospital because of the availability of the operating room facilities and the necessary assistance. The operation is painless and is done under local anaesthesia. Administration of a sedative to patients of nervous temperament is advisable. Palpation of the femoral artery in determining the location of the fossa ovale is helpful. McPheeters' percussion test also is used for locating the femoral saphenous junction. The incision need not be longer than three inches. Most workers prefer an incision parallel to Poupart's ligament. Ochsner, however, thinks that the longitudinal incision

gives a better exposition of the tributary veins at the upper end of the saphenous vein. The vein is doubly ligated, and about 2 cm. of the intervening vein is resected. Transfixion of the vein stumps is done by many workers and omitted by others. Most workers consider ligation and transection of the tributaries of greatest importance to minimize the possibility of recurrences. The most constant tributaries are the external pudendal, the external superficial iliac, and the superficial inferior epigastric. From 3 to 5 c.cm. of the sclerosing solution is injected into the distal segment of the transected vein. The patient is permitted to go home an hour after the operation and is advised to be ambulatory. An elastic bandage is applied to give support.

#### *Care of varicose ulcers*

In the presence of varicose ulcers before the injection of veins is begun, any existing infection should be cleared up by rest in bed, elevation of the extremity, and the application of hot hypertonic solution packs. Mahorner and Ochsner advocate small doses of sulphanilamide to control infection in long-standing ulcers. Krieg uses vitamin B<sub>1</sub> for the control of pain. Ten mg. doses are given three times daily to obtain early saturation, and thereafter half this amount is prescribed. As an efficacious dressing, Mahorner uses gauze that is impregnated in white vaseline containing xeroform 5 per cent. A rubber sponge or the Unna paste boot for compression will control stasis and pain. In office practice, medicopaste or cruricast bandages, an elastoplast, or numerous other similar products will answer the purpose of compression. Where there are ulcers of long standing with considerable scarring, Owens excises the scar tissue and then applies skin grafts.

General ability to recognize dermatologic lesions will aid materially in treating varicose veins and their accompanying skin complications. Quite frequently it is the deficient circulation of the extremity that prolongs the duration of a co-existing skin lesion. Tar products will be found beneficial in the treatment of varicose eczemas. The use of x-ray therapy in small amounts (about 2 skin units total) will also help to obtain satisfactory results.

The frequent association of fallen arches and neglected varicose vein conditions is not a mere coincidence. The care and correction of associated foot deformities is important in the treatment of varicose veins.

#### *Conclusion*

Varicose veins are seen frequently, and the general practitioner should attempt to discover the early cases and treat them prophylactically long before they cause disability and complications. Authors vary as to the incidence of varicose veins, but a survey of crowded beaches will convince anyone of the prevalence of this condition.

In order to detect early varicosities, it is best to examine the patient while he stands on a chair or table, since in this elevated position the small varicosities are more easily visible.

Patients rarely request treatment of early varicosities, for many of them are unaware of having them, but they appreciate the suggested obliteration while under treatment for other conditions. Careful treatment will result in physiologic and cosmetic improvement, thereby gaining for the physician the patient's confidence.

### **A Plea for Enlightened Nihilism in Drug Therapy**

By L. I. ROBERTS, M.R.C.S., L.R.C.P.

(Abstract of an address from the Journal of the Christian Medical Association of India, Burma and Ceylon, Vol. XVI, July 1941)

THE term 'therapeutic nihilism' has been used to indicate the belief and practice of those who do not accept the usual orthodox theories of therapeutics. It is one of the glories of our profession that freedom

of honest thought and action is considered to be not only an incontestable right but also a compelling duty. A recent contributor has stressed the importance of independent thought and investigation and has reminded us of the fact that we owe much to healthy nihilism in our profession. We all know how much unnecessary labour and time to ourselves and how much suffering to our patients has been spared by the bold nihilism of Winnet Orr and Trueta in the treatment of septic wounds.

It has now come to be my firm belief that we can to a large extent dispense with the use of drugs, particularly in out-patients' clinics and dispensaries. This does not include, needless to say, the specifics like quinine and organic arsenic. Nor does it apply to the truly ameliorative drugs, the analgesics, antispasmodics, hypnotics and some others. The above two classes of drugs which may be considered indispensable, form about twenty-five per cent of the drugs in our pharmacopœia. The remaining seventy-five per cent go mostly to make up the placebos, the bottles of medicine which are so dear to the heart and the stomach of the patient and which go to swell our drug bills. These can be cut down by at least half, if not more.

This belief of mine, I think, is held by many in the profession. It is not a 'hobby'. It is a burden which I wish you to share with me.

I cannot do better than quote somewhat at length from an address which Osler gave to the Canadian Medical Association in 1902. This is what he said:

'In the fight which we have to wage incessantly against ignorance and quackery among the masses, and follies of all sorts among the classes, diagnosis, not drugging, is our chief weapon of offence. . . . The peril is that should the physician cease to think for himself he becomes a mere automaton, doing a penny-in-the-slot business which places him on a level with the chemist's clerk who can hand out specifics for every ill, from the "pip" to the "pox". The salt of life for the physician is a judicious scepticism, not the coarse, crude form, but the sober sense of honest doubt expressed in the maxim, "Be sober and distrustful; these are the sinews of the understanding". It may keep him from self-deception and out of the clutches of the arch enemy of his professional independence—the pernicious literature of our camp followers, a literature increasing in bulk in meretricious attractiveness and in impudent audacity. To modern pharmacy we owe much, and to pharmaceutical methods we shall owe much more in the future, but the profession has no more insidious foe than the large, borderland pharmaceutical houses. No longer an honoured messmate, pharmacy in this form threatens to become a huge parasite eating the vitals of the body medical. We all know too well the bastard literature which floods the mail, every page of which illustrates the truth of the axiom, "The greater the ignorance the greater the dogmatism". Much of it is advertisements of nostrums foisted on the profession by men who trade on the innocent credulity of the regular physician quite as much as any quack preys on the gullible public.'

Osler was a philosopher physician. He seems to have been a prophet also. The address I have quoted from was delivered nearly forty years ago. How true it is of to-day! There is no doubt but that our therapeutic armamentarium has been since strengthened greatly by salvarsan and its progeny, by insulin and by the sulphonilamides, to mention but a few. But the health of mankind, physical, mental and spiritual, does not depend for its improvement and perfection so much on the discovery of newer and better remedies for diseases as it does on their prevention and this depends, at the last resort, on the regeneration of man.

Osler was concerned with the good of the soul of our profession. What is truly good for one must be truly good for another, the good of the physician being for the good of the patient and *vice versa*.

So, I believe that it will be for the good of our patients' souls and for our own souls if we would withhold, as far as possible, the bottle of medicine—

I use this but as the symbol of . . . recently the needle has become a . . . to the bottle—which patients in their ignorance desire most of all and which we, in our weakness and from misplaced kindness, give to them.

In the process of evolution, which, sad to say, has taken some queer turns, man has . . . the magic of medicine, and an in the efficacy of medicine-drinking for all and sundry ailments.

Nowhere is this more true than of our country with its almost limitless variety of plants and herbs which provide a happy hunting ground for the numberless medicine men, from the most primitive to the most pretentious and plausible, that infest the country. These foster the belief from self-interest that for every ailment there is a corresponding medicine to take.

The quack probably does not know the great truth that the body, and the mind also, can to a large extent heal itself and he may honestly believe that his medicines effect the cure. But we who know better must also share the blame. 'To whom much is given of him much is expected'. The 'much' that is expected of us is, I believe, not to increase the number of drugs we want but to decrease them. Medicine is an art, and true art consists in achieving one's object with as little an outlay as possible. We should avoid the risk of perpetuating this false belief in medicines as belief in an untruth to both science and religion is one of the mortal sins and this one is all the more dangerous because it brings popularity and profit.

Two factors, as much as any other, have contributed to this false belief in and utter dependence on medicine-drinking by our patients. These are, firstly, the unwieldy number of patients at most of our out-patients' clinics and dispensaries, and, secondly, the ease with which they can be sent away happy with the bottle of medicine. This is the broad gate and the wide way that leads to the loss of not only the doctor's soul but the soul of the patient also. If a doctor is expected to treat from one hundred to three hundred patients in a few hours, the treatment is bound to consist mostly in prescription writing and in a kind of service which cannot but be very second rate. The impressive figures that adorn the pages of a hospital report may not be, from the standpoint of scientific medicine, a matter for congratulation at all but rather, on the contrary, may be a matter for real concern and commiseration.

In spite of the ready medicine-giving and ready medicine-drinking, patients improve and get well. Then why refuse the bottle, this 'faith in solution' as it has been flippantly called?

How are we to cure our patients of the false belief that treatment consists chiefly in medicine-drinking? To do this, first of all, the physician must heal himself. The profession in the West, if one may judge from the medical journals, has passed through a healthy phase of 'therapeutic nihilism'. There has been an outcry against the enormous quantities of mixtures handed out at hospitals and in general practice. There seems to have been a certain reaction even among the public.

But in India we are slow to move. The illiterate villager and the educated townsman have inherited the age-long false belief that for every ailment there is medicinal treatment, external or internal. Let us set ourselves the difficult task of removing this false belief whenever possible. The places for preaching and practice are in our out-patients' departments and our dispensaries. The younger generation is easier to teach and to cure than the older one.

If one doctor has to deal with a very large number of patients, numbering hundreds, a careful interrogation and examination of even 25 per cent of the patients will be impossible. The troubles of at least 50 per cent of our patients are said to be as much psychological as physical in origin. These . . . will need careful interrogation and . . . they can be convinced that a bottle of medicine is not their primary need.

It has been recognized that out-patients are even in greater need of the services of the experienced senior physician or surgeon than are the in-patients. These latter will be in need of careful nursing more than of diagnosis because the diagnosis would usually have been well established before admission except in obscure conditions.

It is only with the help and moral support of the senior member of the staff that the junior member who has been entrusted with the out-patients can speak with authority and say that the bottle of medicine is not needed, or is of very secondary importance.

Another way of protecting the junior from the temptation of prescribing the unnecessary bottle is to cut down rigorously the expenditure on stock mixtures

which adorn the dispensing table. One is thus forced to do something more than mere prescribing.

I have said enough, though in a laboured and disjointed manner, to show that the present practice at the large public dispensaries and out-patients' departments of hospitals is not what it might be. Let us resolve to make our service worthy of the knowledge we possess and the faith we profess.

[We sincerely hope that our readers will understand the message conveyed in this address better than did at least one distinguished member of the audience, and further that some of them will have the courage to act upon what so many of us know to be the truth regarding the abuse of the placebo, and will cease to prescribe or inject just because it 'comforts the patient.'—EDITOR, *I. M. G.*]

## Reviews

**TECHNIQUE OF GASTRIC OPERATIONS.**—By Rodney Maingot, F.R.C.S. (Eng.). 1941. Oxford University Press, London, Humphrey Milford. Pp. xii plus 240. Illustrated. Price, 15s. Obtainable from the Oxford University Press, Bombay and Calcutta

MR. RODNEY MAINGOT has added another bright light to his already extensive array of books, and this volume may be classed as one of his most informative works.

The *Technique of Gastric Operations* was written primarily with the object of combining in one treatise all those operations which are usually or unusually practised on the stomach. Mr. Maingot has himself performed all these operations, and consequently his opinion of those which he considers the best must command attention.

The illustrations are for the most part original, and are excellent, especially for their clarity. The closing chapters of the book are devoted to a brief account of the preparations of the patient for his operation and also the details of post-operative treatment, both of the complicated and uncomplicated cases.

A splendid book, and one which will prove of great help to any surgeon.

**A HANDBOOK ON DIFFICULT LABOUR.**—By M. L. Treston, F.R.C.S., F.R.C.O.G., Colonel, I.M.S. 1941. A. B. M. Press, Rangoon, Burma. Pp. 124. Illustrated. Price, Rs. 5

COLONEL TRESTON has written this small book for the express purpose of bringing together many of the factors which give rise to difficult labour. For as he truly states, when a lecturer or student wishes to look up in a textbook certain points in connection with dystocia, he has to search textbooks from end to end in order to obtain anything like a comprehensive list. The author has achieved this design albeit in a small volume. He has furthermore not confined himself to the subject which the title of the book would suggest, but has touched also on conditions such as post-partum hemorrhage, and the treatment of chronic inversion and of uterine displacements. He closes his volume with a description of the operation of dilatation and curettage, which description is illustrated with two excellent diagrams. He is to be congratulated on the inclusion of this all-important operation, which as he truly states is so frequently described as such a simple performance that anyone can do it.

The volume can be recommended to students, and when read in conjunction with textbooks will prove of useful help.

**SUPPLEMENT TO PHARMACOLOGY AND THERAPEUTICS (WITH SPECIAL REFERENCE TO TROPICAL DISEASES).**—By M. A. Kamath, M.B. & C.M. 1941. Published by the Author from Sharada Press, Mangalore. Pp. 98 plus ix. Price, Re. 1-8

This little book of about 100 pages is intended to supplement the text of the older book of the same

title published in 1933 by the author, in collaboration with Dr. R. Narayan Nair. Much water has flowed under the bridges since 1933 and in keeping with the progress of medicine and chemistry, the science of pharmacology and therapeutics has advanced considerably. By issuing the supplement to the original text, the author has evidently made a pious attempt to bring the subject-matter up to date and in line with the modern state of knowledge on the subject. While he has achieved a certain amount of success in this respect, the reviewer feels that it would have been much more profitable to the reader if the author decided to have a new edition of the book wherein he could avail himself of the opportunity of revising the old text thoroughly. On critical reading, it seems clear that the old text of 1933 requires a considerable amount of revision, re-writing and incorporation of new material, as our ideas with regard to the action and uses of many old remedies have undergone a good deal of re-orientation along with progress in knowledge about new therapeutic agents.

In line with the main treatise on pharmacology and therapeutics to which this book is a supplement, the text is arranged in alphabetical order, emphasis being given to the non-official remedies and other recently-introduced medicinal specialities, such as sulfanilamide compounds, mandelic acid and its salts, protamine-zinc insulin, histidine, nicotinic acid, prostigmine, etc. Commendable effort has been made in the compilation, but the description of individual remedies is often so condensed and reduced that clarity is sometimes sacrificed. Subject grouping has been rather peculiar in some places. As an example may be cited the mention of 'physostigmine salicylas' under the head 'organotherapy'. The book may be of value as a ready and handy reference manual for busy junior practitioners but it is hardly likely to earn a place in the library of those who wish to possess an authoritative reference manual.

B. M. I

**ANNUAL REVIEW OF BIOCHEMICAL AND ALLIED RESEARCH IN INDIA.** Volume XI for 1940. Published by the Society of Biological Chemists, Hebbal P. O., Bangalore (India). Pp. 173. Price, Rs. 3 or 6s.

THIS is a well-bound and well-printed book of 162 pages with complete indexes of authors and subjects.

It is divided into 16 sections written by different authors and each section gives an adequate account of all the papers appearing on the particular subject during the year.

This book is essential for all biochemical workers in India to prevent their duplicating or repeating work already done, and it will also be of value to workers in other countries to indicate to them the great scope in India of this increasingly important branch of science.

**A HANDBOOK FOR INDUSTRIAL NURSES.**—By Marlon M. West, S.R.N., S.C.M. 1941. Edward Arnold and Company, London. Pp. xi plus 134. Price, 3s. 6d.

This excellent manual should be a reference book for every worker in industrial health, for two reasons. Firstly, it outlines in detail the duties of the industrial nurse in a manner that not only serves as a guide in nursing but, what is equally important, provides the medical officer with an outline of those industrial medical activities, essential for any standard of industrial health which can only be carried out by the qualified nurse. Secondly, Miss West has provided an admirable summary of the industrial medical service in England, including not only legislation affecting factory workers and the general duties of the medical officer, but also coordination of industrial health with other welfare services. The chapter on records and record-keeping is of particular usefulness. The book should prove of real value in India where industrial medical services are now extending but as yet chiefly under private initiative and consequently without standards for which this manual can serve as guide.

J. B. G.

**HEALTH BULLETIN, NO. 16 (MALARIA BUREAU, NO. 7). 'SYNOPTIC TABLES FOR THE IDENTIFICATION OF THE FULL-GROWN LARVÆ OF THE INDIAN ANOPHELINE MOSQUITOES'.**—By I. M. Puri, M.Sc. (Punjab), Ph.D. (Cantab.), F.R.E.S. Fourth Edition. 1941. Published by the Manager of Publications, Delhi. Pp. v plus 109. Illustrated. Price, As. 14 or 1s. 3d.

As this bulletin is primarily intended for the use of field-workers, the advanced synoptic table given in previous editions is considered unnecessary and only one main table is given in this edition (3rd). This main table includes all those species, so far recorded from India, Burma and Baluchistan, of which the larvæ are known.

The whole of the anopheline fauna of the Indian area appears to be composed of a number of different elements—the Mediterranean element, the Indian element, and the oriental element (including the oriental alpine element). Though there is a great deal of intermingling of the different elements yet, there are certain species whose distribution appears to be restricted to particular areas. The identification of the larvæ of all the species constituting the different elements is undoubtedly considered much more difficult than that of the adults. Unfortunately, no diagnostic characters simpler than those already used in the synoptic table have so far been found practicable, and the main synoptic table, dealing with all the species belonging to the three elements which have so far been recorded from India, is at times considered very complicated. This is especially the case in regard to those workers who are dealing with only the limited number of species occurring in their own particular area. In order to facilitate identification of larvæ by such anti-malaria workers, five separate tables have been given in this bulletin in addition to the main synoptic table. Each of these tables deals with only a limited number of species and is intended for the use of persons working in particular areas.

Until recently no reliable characters were known for differentiating the larvæ of *A. sundaus* from those of *A. subpictus*. Ghosh (Bengal) and Venhuis (Dutch East Indies) have now drawn attention to certain characters which, though not diagnostic in 100 per cent of cases, may, when taken together, serve to differentiate a large majority of specimens of these two species. These characters have now been incorporated in this new edition (4th) and it is hoped that those working in the *sundaus* areas will find them helpful. It will, however, be advisable not to rely on any one character by itself but to base the identification only on a combination of these.

This bulletin is a publication of vital interest to entomologists and malarialogists in India.

## Abstracts from Reports

**ANNUAL REPORT ON THE WORKING OF THE ASSAM MENTAL HOSPITAL, TEZPUR, FOR THE YEAR 1940.** BY LIEUT.-COLONEL A. M. V. HESTERLOW, M.B., Ch.B. (EDIN.), B.Sc., P.H. (EDIN.), D.T.M. & H. (EDIN.), I.M.S., INSPECTOR-GENERAL OF CIVIL HOSPITALS, ASSAM

The whole hospital population was regularly treated for hookworm and other intestinal parasites. Skin diseases and cases of pyorrhoea alveolaris were regularly attended to. New admissions were vaccinated against smallpox and inoculated with cholera vaccine as a prophylactic measure. Blood specimens (serum) of all admissions were sent to the Pasteur Institute, Shillong, for Wassermann test—positive cases were given anti-syphilitic treatment. Mental patients are given as much freedom as is compatible with safety. The staff of keepers and guards have been taught the ideal of treating the inmates as sick persons and that their attitude towards them should be that of a nurse.

The former superintendent recommended in his report of 1939 under General Remarks—'Gradation of Patients'—the construction of a convalescent home for those patients who are on way to recovery. The present superintendent endorses and repeats the recommendations. The suggestion deserves sympathetic consideration, as such patients during the process of recovery are adversely affected by association with chronic cases requiring asylum, and their chances of complete recovery may be permanently prejudiced by such contact.

Though the sinking of a 2½-inch diameter tube-well during 1939 eased the water situation to some extent the supply is still very inadequate for a population of over 1,000 including staff. The total available water

per day is about 6,500 gallons. It is clear from the previous reports and representations of the superintendent that even with the new tube-well to supplement the water-supply from the Municipal mains, the dearth of water is still very great.

About 5,600 articles of clothing have to be dealt with such as blankets, blanket-kurtas, cotton-kurtas and cotton-jungiahs weekly, and infected and soiled clothing daily in an old crude blanket boiler. Such a large quantity of clothing cannot be effectively and regularly dealt with in such boilers. The necessity of a proper disinfecter of the high pressure steam variety has been placed before the Government. This is under consideration of Government and is an urgent need which should be met as early as possible.

**SEVENTY-EIGHTH ANNUAL REPORT OF THE GOVERNMENT CINCHONA PLANTATIONS AND FACTORY IN BENGAL FOR THE YEARS 1939-40**

The most notable feature in the quinine trade during the past decade has been its steady price subject only to minor fluctuations following mainly on exchange movements. The outbreak of hostilities in Europe in the year under review has, however, profoundly affected the trade.

There has been a steady increase in the price of quinine and related products until quinine sulphate now stands at Rs. 37 as against an average of Rs. 24 immediately before the war. The rise in the basic price has, however, been small amounting to only 7 per cent of the total rise. An export duty imposed by Java accounts for another 5 per cent while the increase in freight and insurance charges amounts to



8 per cent. The balance of the difference between pre-war and present rupee prices is accounted for by the exchange depreciation.

Apart from high prices the consumer of quinine in India is also suffering from a shortage of supplies. The usual European sources have naturally dried up. Java has ample stocks, but transport difficulties and withdrawal by Java of the usual credit facilities have restricted the import trade. Government supplies, whether of local manufacture or of foreign origin, meet, as before, only a portion of the total demand. The situation points to the importance of regarding quinine as a key industry in tropical countries. It is to be hoped that India will make a serious effort towards the attainment of self-sufficiency in this essential commodity.

Of the total quinine sulphate only 5,056 lb. were left in the crude state, the rest being purified to the Government standard. A further 23,889 lb. of the Government standard quinine had to be prepared from old stocks of crude to meet the total demands in the reserve and unreserved fields of distribution. Quinine sulphate of B.P. standard was manufactured to the extent of 16,025 lb. from previous crude stocks for supply to agents.

Other quinine salts manufactured during the year came to 1,736 lb., of which 1,636 lb. is accounted for by quinine hydrochloride and quinine bihydrochloride and the remaining 100 lb. by quinine bisulphate and bihydrobromide. The installation of a new plant for quinine hydrochloride and bihydrochloride was completed during the year. The bihydrochloride is now made only to the B.P. specification while the hydrochloride is made of a cheaper grade as well.

The provincial stock of quinine, the great mass of which lies in the crude state, was 49,022 lb. at the end of the year, being 17,536 lb. down on the opening balance. Quinine tablets by weight are up from 2,632 lb. to 2,761 lb. and by treatments are up from 7,465 boxes to 18,420 boxes. Febrifuge powder is up from 11,653 lb. to 13,697 lb. and febrifuge tablets down from 1,665 lb. to 1,658 lb. The stock of dry plantation bark opened at 1,124,834 lb. and closed at 1,395,159 lb.

#### ANNUAL REPORT OF THE CHEMICAL EXAMINER TO GOVERNMENT, UNITED PROVINCES AND CENTRAL PROVINCES, FOR THE YEAR 1940

The following cases illustrate the danger of the practice of administration of drugs by incompetent persons:—

Two persons were suffering from asthma; they were under the treatment of a *vaid*, who gave them some yellowish powder as medicine. Soon after taking the medicine, they began to vomit and purge and both of them died within 12 hours. Potassium dichromate was detected in quantity in both the viscera.

(ii) In a case from Etawah, portions of viscera of a man, who died within 20 minutes after taking some medicine for gonorrhoea, were received. Potassium cyanide and arsenic were detected in the portions of viscera and in the liquids seized from the accused.

(iii) A *vaid* brought a letter of recommendation (alleged to have been written by a Raja) to one Raja Sahib. The latter was advised to utilize the services of the *vaid* for treatment of the Rani Sahiba, who had no child. The *vaid* assured them that the Rani Sahiba would have a child after taking the medicine given by him. The *vaid* took 2½ tolas of gold, 3½ tolas of silver and 5 tolas of copper from the Raja Sahib and mixed them with medicine and amulets in a *handi*. In the evening, he transferred the contents of the *handi* to a cup and sent it to the Rani Sahiba, who was asked to drink the liquid and return the gold, etc. to him. He then pretended to transfer the gold, etc. to the *handi* and left. The Raja Sahib had some suspicion and he had the *handi* opened. The *handi* contained only pebbles. The *vaid* was sent for and, on search, gold and all other articles were recovered from him. The liquid medicine seized from him, on analysis, was found to be dilute nitric acid.

#### TRIENNIAL REPORT OF THE CIVIL HOSPITALS AND DISPENSARIES OF MODERN MEDICINE, GOVERNMENT OF MADRAS, FOR THE YEARS 1938 TO 1940

*Medical relief.*—The number of civil hospitals and dispensaries in the province rose from 1,283 to 1,336 during the three years ending the 31st December, 1940. The number of beds in hospitals increased from 10,670 to 13,510 during the period. The beds reserved for women increased from 5,590 in 1938 to 6,123 at the end of 1940. The number of in-patients treated increased from 310,030 in 1938 to 352,951 in 1940. The proportion of women patients has steadily increased since 1912; in 1912 only about 3 women were admitted for every 5 men; in 1940 about 14 women were admitted for every 17 men. The number of out-patients increased from 18,692,411 in 1938 to 19,655,711 in 1940. Operations and labour cases numbered 687,894 and 129,045 respectively, the corresponding figures of 1938 having been 735,101 and 123,381.

Among the diseases which accounted for the largest number of patients treated, there was a marked fall in the number treated for diseases of the eye. There was also a decrease in the number treated for diseases relating to the ear and the circulatory system. On the other hand there was an increase in the number of patients treated for diseases relating to the digestive system (excluding diarrhoea, dysentery and tumours), and diseases of the respiratory system, malaria and rickets.

The Madras Provincial Tuberculosis Association was organized in 1939 and district associations have been formed. The immediate object of the district association is to provide a tuberculosis clinic at each district headquarters hospital. To provide qualified medical officers for these clinics, the Government have sanctioned the Tuberculosis Diseases Diploma Course. The course lasts nine months and the first course began in July 1940.

*Rural medical relief.*—The number of subsidized rural dispensaries rose from 404 at the end of 1937 to 435 at the end of 1940. Several reforms were introduced during the triennium to improve the scope of the Rural Medical Scheme—particularly in respect of (a) appointment of midwives to rural medical dispensaries, (b) disciplinary control over rural medical practitioners, (c) deputation of rural medical practitioners to neighbouring villages. The scheme was originally intended to induce medical practitioners to settle in villages, where they would earn a living by private practice among the richer classes and give free treatment to the poor in return for a Government subsidy and a free supply of drugs. Government are now examining the extent to which these purposes have been achieved.

*Leprosy.*—From the 1st April, 1939, intensive and concentrated work on leprosy was entrusted to the Provincial Branch of the British Empire Leprosy Relief Association. In addition 464 leprosy clinics were functioning throughout the province for treatment of leprosy cases under the supervision of the district medical officers and superintendents of hospitals.

*X-Ray departments.*—X-ray departments in Government hospitals continued to be of great help both from the diagnostic and from the therapeutic standpoint. In 1939 x-ray equipment was installed at the Headquarters Hospital, Palamcottah, the Government Tuberculosis Sanatorium, Tambaram, and the Government X-ray Institute, Egmore, Madras. Two courses of training in radiology have been organized, the D.M.R. (Diploma in Medical Radiology) course for medical practitioners and the C.R.A. (Certified Radiological Assistants) course for subordinates in radiological departments.

*Medical education.*—The outstanding change has been the abolition of the L.M.P. course. This involved the abolition of the Lady Willingdon Medical School for Women, Madras, and the conversion of the Stanley Medical School into a College. A Central Institute of Anatomy and Physiology, including organic chemistry



and biochemistry, has been provided to serve both the medical colleges in Madras.

**Medical services.**—Two women civil surgeoncies were created in 1938. In 1940 the post of Superintendent of the Victoria Caste and Goshia Hospital, Madras, which had for a long time been held by a member of the Women's Medical Service, India, was also converted into a civil surgeoncy, so that it might be held by a member of the Madras Medical Service (Women's Branch).

In teaching, four posts of lecturers were converted into posts of Professors. Government issued orders which would lead to the steady replacement of paid medical officers by honorary workers. Experience has revealed certain difficulties in the practical application of the scheme and Government are now considering necessary changes.

**Nursing staff.**—Early in 1940, a committee was appointed to report on various questions relating to nursing services in hospitals. Orders have been issued on some of the recommendations and others are under the consideration of Government.

**General.**—The Government note with satisfaction the testimony borne by the Surgeon-General to the work done by the advisory committees and the visiting committees of the various hospitals. They welcome the tendency of charitable persons to make donations for the treatment of sick persons. Private philanthropy has been responsible for the provision of—

- (i) a cancer ward in the Government Women and Children Hospital, Madras;
- (ii) a dining platform for patients in the Ophthalmic Hospital, Madras;
- (iii) a block of buildings for conducting instructional classes for defective children in the Mental Hospital, Madras; and
- (iv) a maternity block in the Government Hospital, Kollegal, and patients wards in a few other mofussil hospitals.

#### ANNUAL REPORT OF THE DIRECTOR OF MEDICAL SERVICES, HONG KONG, FOR THE YEAR 1940

THE health and sanitary conditions in Hong Kong during 1940 continued to be influenced by the presence of several hundred thousand refugees from war areas in China, with resulting overcrowding, high rentals, increased cost of food and fuel and noticeable under-nutrition amongst a large proportion of the population.

Shortage of food of satisfactory quantity and quality was reflected in the appearance in epidemic form for the first time in the history of the colony of a fatal form of pellagra (953 cases, 442 deaths). Deaths from beri-beri, including the infantile type, rose from 3,189 in 1939 to 7,229 in 1940. Tuberculosis also took a higher toll with 5,751 deaths during the year under review as compared with 4,443 in 1939. These figures are all the more significant in view of the fact that the population at risk was lower at the end of 1940 than at the beginning of the year.

The cholera outbreak started late, but was attended by a high case mortality (66.2 per cent) and left behind an under-nourished community with a high 'carrier' rate amounting to over 20 per cent in certain congested districts. This combination, associated with a sadly defective system of nightsoil collection from 65,000 tenement floors, is likely to be followed by very serious consequences in 1941.

Smallpox was controlled to some extent by mass vaccination, over 2½ million vaccinations being performed during the year. In relation to this, it should be remembered that British river steamers alone brought to the colony over one million passengers during 1940, all of whom were vaccinated before landing if they had not been so protected during the preceding three years.

Typhoid and dysentery continued to exact a heavy toll on human life and may be expected to do so in future until the primitive methods of town conservancy are finally eliminated, and the cost of food and fuel for the masses is more in keeping with their earnings.

## Correspondence

### LEUCODERMA

SIR,—In your September issue, the importance of treatment of bowel condition has rightly been stressed. In some of the few cases that came under my treatment, I have not had good results with oil of bouchi application, though intestinal antiseptics have been administered for a long time. In these cases the application of oil of bouchi gave good results when some polyglandular substance was also given. Often in females, I have found leucoderma patches appearing with the onset of puberty, and in some they increased considerably during the time of the menopause.

S. B. DAS GUPTA, M.B. (Cal.).

SHILLONG,

17th November, 1941.

## Service Notes

### APPOINTMENTS AND TRANSFERS

#### To be D.D.M.S. of a Command

MAJOR-GENERAL H. J. M. CURSETJEE, D.S.O., K.H.S. Dated 4th September, 1941.

Colonel W. C. Paton, M.C., is appointed Honorary Physician to the King, 27th March, 1941 (*vice* Major-General I. M. Macrae, C.B., C.I.E., O.B.E., who has retired).

The services of Lieutenant-Colonel W. P. Hogg, M.C., an Agency Surgeon, are temporarily replaced at the disposal of His Excellency the Commander-in-Chief, with effect from the 11th July, 1941.

Lieutenant-Colonel F. H. Whyte is appointed Civil Surgeon, New Delhi, with effect from the forenoon of the 14th October, 1941.

Lieutenant-Colonel W. M. Will is appointed Officer on Special Duty for two months in the first instance, with effect from the afternoon of the 18th October, 1941.

The post of the Professor of Operative Surgery, K. E. Medical College, Lahore, is held by Lieutenant-Colonel V. R. Mirajkar, O.B.E., Professor of Surgery, in addition to his own duties with effect from the afternoon of the 14th June, 1941, when Major B. S. Nat proceeded on military duty.

The services of Major M. H. Shah are placed temporarily at the disposal of His Excellency the Commander-in-Chief, with effect from the 3rd September, 1941 (afternoon).

Major G. F. Taylor, Professor of Clinical Medicine, K. E. Medical College, Lahore, who is officiating as Professor of Medicine, *vice* Lieutenant-Colonel Amir Chand, since 14th July, 1941, made over charge of the Office of Professor of Clinical Medicine to a non-I.M.S. officer on the 1st October, 1941, forenoon.

Major B. M. Rao is confirmed as an Agency Surgeon, with effect from the 14th October, 1941.

Major W. T. Taylor is appointed Deputy Assistant Director-General (Medical Stores), Medical Store Depot, Bombay, with effect from the afternoon of the 18th October, 1941, *vice* Lieutenant-Colonel W. M. Will, placed on Special Duty.

On completion of his tour of duty at Murree, Major J. P. J. Little assumed charge of the Office of Civil Surgeon, Rawalpindi, on the forenoon of the 27th October, 1941.

The Secretary of State for India has sanctioned the reversion to military employment of Captain C. J. H. Brink, with effect from the 2nd December, 1940.

Captain G. S. Chopra, A.I.R.O., is appointed Deputy Assistant Director-General (Medical Stores), Medical Store Depot, Karachi, with effect from the 18th October, 1941.

**INDIAN LAND FORCES**  
(Emergency Commissions)  
To be Captain (on probation)  
5th June, 1941

Teja Singh Uberoi, with seniority from 10th December, 1937.

Lieutenant (Acting Major) B. K. Sheorey (Emergency Commission) is appointed Deputy Assistant Director-General, Indian Medical Service (Air Raid Precautions), with effect from the 23rd June, 1941.

Lieutenant A. D. Iliff (Emergency Commission) is appointed temporarily to officiate as an Agency Surgeon, with effect from the 15th April, 1941, and is posted to the North-West Frontier Province, with effect from the same date.

Lieutenant R. K. Garde (Emergency Commission) is appointed Additional Officer at the Medical Store Depot, Bombay, with effect from the 21st October 1941.

The undermentioned Lieutenants (on probation) are confirmed in their ranks, with effect from the date specified:—

14th June, 1940

A. A. Malik.	S. Banerji.
S. Mukerjee. Dated 15th October, 1940.	
C. L. Kashyap. Dated 15th November, 1940.	
S. K. Lal. Dated 2nd December, 1940.	

3rd January, 1941

G. B. Bowater.	B. I. Evans.
T. B. W. Phillips.	E. G. R. Butler.
J. F. McGarity.	N. St. G. Wade.

R. Hermon.

A. N. Kalra. Dated 15th January, 1941.

The undermentioned appointments are made:—

*To be Lieutenants*

Siegfried Fritz Seelig. Dated 22nd May, 1941, with seniority from 22nd May, 1940.

Oliver Broadgate Brears. Dated 29th May, 1941, with seniority from 29th May, 1940.

James Montague Flower. Dated 2nd January, 1941.

Francis Murray. Dated 5th June, 1941, with seniority from 5th January, 1941.

Arthur William Booth Strahan. Dated 15th January, 1941.

Donal Robertson. Dated 16th January, 1941.

Peter Storrs Fox. Dated 3rd February, 1941.

15th February, 1941

Cecil Macindoe Burnie.

James Romanes Davidson.

Angus Leslie Sutherland.

Henry Bowlby Tristram Holland. Dated 17th February, 1941.

William Donkin. Dated 2nd March, 1941.

The undermentioned are granted emergency commissions:—

*To be Lieutenants (on probation)*

Walter Gilray Anderson. Dated 15th March, 1941.

12th April, 1941

Ambrose Edgar Stevens.

James Denis Hardy.

Ernest Llewelyn Lloyd.

Frank Lake. Dated 13th April, 1941.

Arthur Durnford Iliff. Dated 15th April, 1941.

5th May, 1941

Lindsay John Michael.

Reginald Henry Neeve.

Manikkath Narayana Menon.

Radha Raman Lal.

Surendra Nath Chatterjee.  
Shiva Bhajan Prasad Tewari.  
Kali Sankar Bagchi.  
Kozhimannil Abraham Abraham.  
Jagadis Chandra Das Gupta.  
Shunmugavel Maragathavel.  
Rahatullah Khan.  
Govind Shamrao Vingle.  
Partay Chand Badhwar.  
Madhab Chandra Bhattacharyya.  
Riaz-ud-Din Quraishy.  
Mukunda Seshagiri Prabhu.  
Vaigalathur Sundaramier Ramaswami.  
Ainuddin Ahmad.  
Asghar Naim Ansari.  
Christopher Arumainayagam.  
Patrick Francis Mathias.  
Sita Ram Kaura.  
Nripendra Narayan.  
Nariman Kaikhushru Shroff.  
Ram Swarup Gupta.

6th May, 1941

Henry Cecil Duncan.  
Hamish William Thomson Martin.  
Hirendra Mohan Gangopadhyay.  
Velu Vaidyer Krishna Vaidyer.  
Amir Chand Narula. Dated 8th May, 1941.

5th June, 1941

Geoffrey Donald Lehmann.  
Mohammad Qasim Ali.  
Yashwant Dattatray Deshpande.  
Navroji Manekji Kalapesi.  
Thekvetil Ninan Chacko.  
John Pakiam.  
Gurmukh Das Agarwal.  
Gehi Wadhmal Keswani.  
Jitendra Chandra Chakrabarti.  
Abani Kumar Das Dastidar.  
Deva Prosad Ray.  
Sarat Chandra Srimani.  
Jiban Krishna Bose.  
Joseph Elmer Grief Baker.  
Mahendra Vikram Singh.  
Chethalavada Sanjeevi Venkatasubramaniam.  
Velacheri Kuppuswamy Sundaram.  
Bahadur Singh Nagra.  
Sri Krishna Suri.  
Mumtaz Alam Khan.  
Alfred David Paul.  
Jose Luciano Glennie Pinto.  
Mian Akbar Jan.  
Pundi Srinivasa Raghavan.  
Gurpur Damodar Sheno.  
Chandulal Shiolal Tamboli.  
Palayathil Velandi Krishnan.  
Digambar Shivramsa Khatri.  
Nanabhai Framroze Lilauwala.  
Kirpal Singh.  
Maduriah Chetti Muniswamy.  
Gajanan Dattatray Joglekar.

6th June, 1941

Amulya Kumar Saha.  
Prabhas Kumar Sen.  
Rama Krishna Chettur.  
Kumbakonam Srinivasa Rao Sarangapani.  
Ramamurti Arunachalam.  
Bisheshwar Dayal. Dated 7th June, 1941.

6th July, 1941

Hugh Flack. John Hay Arthur.

5th August, 1941

Edward Beaumont Woodhouse.  
Marie Wilfred John Joseph Pinto.  
Eric Mervyn Craggs.  
Lawrence Augustus Basil Matthews.  
Newman Joseph Child de Lemos.  
Joseph Francis Mason.

as Lushington.  
Lancelet T. Joseph Burby.  
George Evert Dracup. Dated 6th August, 1941.  
Denzil F.

## PROMOTIONS

Colonel to be Major-General

Paton, M.C., K.H.P. Dated 23rd August, 1941.

To be Acting Major-General

Monel J. Taylor, C.I.E., D.S.O., K.H.S., whilst holding appointment of Director, Central Research Institute, Kasauli. Dated 14th February, 1941.

## Captains to be Majors

Dated 2nd February, 1941.

H. G. Reed. C. C. Kapila.  
A. Ledger. W. W. Laughland.  
J. White.

G. Kingston. Dated 28th October, 1941.

## LAND FORCES

## (Emergency Commissions)

Note.—The seniority of the undermentioned officers in their present rank of Captain is ante-dated to the dates specified:—

3rd August, 1940

H. S. St. John-Brooks. G. C. Tresidder.  
Shaw. R. H. Vasey.  
R. Smith. J. M. French.

## Lieutenants to be Captains

14th June, 1941

A. Malik. S. Banerji.  
G. Hyder. Dated 19th September, 1941.

23rd September, 1941

M. K. Bhaduri.	C. P. Cheriyan.
S. A. Laskor.	M. B. Kekre.
C. Misra.	A. C. S. Nambiar.
Paul.	P. I. George.
A. A. Khan.	S. N. Basu.
S. Baxi.	B. J. Rao.
S. Ayyar.	S. C. Ray.
J. Dharmaraj.	S. K. Ghosh.
P. V. George.	K. C. Dube.
Money.	R. M. Nadkarni.
L. Gaind.	B. S. Wagley.
E. Sarangapany.	S. P. Ramakrishnan.
H. N. Hussain.	K. N. Mathur.
A. K. Marwat.	P. A. Narayan.
P. N. Banerjee.	B. S. Sharma.
M. Sharma.	V. R. Bagwe.
S. M. Q. Hoda.	M. R. Thakar.
I. S. Jetley.	A. Aziz.
K. N. K. Menon.	J. H. Patel.
K. Atri.	S. B. Sinha.
S. V. Joseph.	S. Mascarenhas.
H. N. Dastur.	D. D. Mitra.
P. Kailasam.	P. Chand.
P. I. Jacob.	M. Said.

## Notes

## AVITOL

This is a medicinal fish-liver oil, which is suitable as a substitute for cod-liver oil.

It is being manufactured in different places in India. It is known as medicinal fish-liver oil in Madras, and shaliverol in Travancore State.

Its vitamin-A content is much higher than that of cod-liver oil and, chemically, it is practically the same as cod-liver oil.

Its efficacy of treatment in vitamin-A deficiency cases is quite satisfactory; it has now been used in Calcutta

for the past year; it has been found an excellent substitute for cod-liver oil; clinically no untoward symptoms (e.g., nausea, vomiting, diarrhoea, etc.) have been encountered. Its smell and taste are the same as cod-liver oil and the cost is less than the pre-war prices of cod-liver oil.

It is available in bulk (1) in Madras (as medicinal fish-liver oil) from the Director of Industries and Commerce, Madras, (2) in Travancore State (as shaliverol) from the Director of Marine Biology, Travancore State, Travancore, and (3) in Calcutta (as avitol).

## CADMINOL

THE UNION DRUG CO. announce the introduction of their latest product Cadminol, containing cadmium thiogluconate 1½ per cent in oily suspension for the treatment of tuberculosis.

Reports on pre-introduction trials indicate that the preparation is dependable in every respect. Trials are also being conducted in some of the tuberculosis sanatoria and hospitals in this country.

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